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# CHEMICAL & METALLURGICAL ENGINEERING

H. C. Parmelee
*Editor*

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## *Prohibition Moves to Control Industrial Alcohol*

WITHOUT consulting manufacturers or consumers of industrial alcohol, or conferring with the Alcohol Trades Advisory Committee, General L. C. Andrews, Assistant Secretary of the Treasury in charge of prohibition enforcement, recently asked the Ways and Means Committee to put a tax of one cent per gallon on denatured alcohol. The basis of his proposal was frankly to "give us excise supervisory authority so that we may control better the uses of denatured alcohol." This naïve suggestion can be characterized in the words of one witness as "chaining all the dogs in order to catch the sheep-killing dog."

THE General disappoints us. His original program for control of the manufacture and use of alcohol and for reorganization of the proposed enforcement machinery sounded well, but actual developments have scarcely merited approval. Apparently he has truckled with politicians and the Anti-saloon League, and now he proposes to make honest industry pay part of the bill for prohibition enforcement, for which there is already adequate provision if honestly and efficiently applied.

BUT there is a greater menace in the proposed tax of one cent per gallon than the mere financial burden. The nuisance of additional red tape and interference would be intolerable. And if a tax of one cent will yield a comfortable revenue to aid enforcement, why not twenty-five cents or more in order to raise the whole fund? Maybe the penny is the entering wedge for the larger coin. And perhaps revenue raised in this way would relieve the authorities from the publicity attending their ever-increasing demands on Congress for funds with which to beat the bootlegger.

FORTUNATELY the Ways and Means Committee is engaged in reducing, not increasing, taxes, and members of the committee called this to General Andrews' attention, characterizing his plan as out of harmony with the policy of the Government. Be it said to his credit that he had also recommended a reduction in the tax of \$2.20 per proof gallon on pure alcohol to the pre-war rate of \$1.10, but he did not press it heartily. In fact he expressed himself as "much stronger" for the penny tax on denatured alcohol.

APPARENTLY this plan to tax a raw material of industry fell on deaf ears, which is fortunate in view of the fact that industry knew nothing of it in advance and consequently had no chance to voice its opposition. As far as we are aware the Ways and Means Committee has not accepted the idea, though it has adopted the proposal to cut in two the tax on pure alcohol. It will pay, however, to watch further moves on the part of the prohibition enforcement authorities during the coming session of Congress.

## I. G. Bracing Itself At Home and Abroad

DESPITE the fact that for six months past foreign news despatches and trade reports have been filled with rumors of threatening consolidations and combinations within the German dye industry, the American manufacturer has been content to sit back and await developments. His attitude is not exactly that of smug complacency or even unconcern, but rather one of knowing satisfaction in having anticipated the course of the enemy and having prepared, to some extent at least, for his strategy. However, when recent events in Germany and this country are properly correlated they form an interesting chain of developments that may well be regarded as preparation for an intensive struggle.

It was only natural that the German combine—once the stumbling block of reparation dyes had been removed—should begin bracing itself for a heroic attempt to recapture its foreign markets. At first the effort was directed toward the internal organization in order to bring down production costs by more efficient operation. Next came the proposal of a merger of the principal constituent firms in order further to reduce competition between the individual members of the cartel. Centralized control of production and purchases was planned as a means of strengthening these departments. But most important from the standpoint of the American industry, was the scheme to consolidate the separate sales organizations maintained by each concern into a joint agency for the control of both the home and foreign markets.

Apparently some little difficulty was experienced in bringing about these changes, not only because of the financial arrangements involved, but also because of a high government tax attending such a consolidation. Gradually, however, these obstacles were overcome and only within the past month has come the announcement of the completed reorganization with the formation of a single great holding company having a total capitalization of 646,000,000 gold marks and to which the former members of the cartel are in the position of subsidiaries. There has also been a new allocation of manufacturing, with the setting up of four major production units. Likewise the numerous sales branches have been unified and headquarters transferred to Frankfort. A new board of directors under the chairmanship of Dr. Carl Bosch of Ludwigshafen has been provided and that already powerful organization has been further strengthened by an administrative board made up of such men as Dr. C. Duisberg of Leverkusen, Dr. W. von Rath of Hoechst, Dr. C. Mueller of Ludwigshafen and C. von Weinberg of Frankfort.

Although the major activities have so far centered in Berlin, there have been several minor skirmishes in this country that would lead one to believe that the same rigorous policy of consolidation is to be applied all along the line. Here under the leadership of the conspiring Colonel Metz, a new corporation was formed last July, presumably merely to take over the dyestuff business of his own manufacturing company and his importing agency for the Hoechst member of the I. G. He was also joined in his new company by the agent for the Cassella firm of Frankfort, yet at the time this association was not one that attracted wide attention. The surprise came later when the Grasselli dyestuff Corporation, having already completed a manufacturing and importing arrangement with Baeyer of Leverkusen and having withdrawn from the trade association of the domestic manufacturers, cast its lot with Metz and Ludwig. Thus, lacking only Badische's representative, we find the principal members of the new Interessen Gemeinschaft presenting a united front in their renewed competition with the American industry.

These developments, both at home and abroad, furnish a striking confirmation of the predictions made by the industry at the time it requested and received a fair measure of tariff protection. To say that all of them have been anticipated by our manufacturers is perhaps not entirely true. Certainly, however, the industry appreciates more than ever before that its future will depend upon research that will point the way to leadership and chemical engineering development that will make possible large-scale, efficient and competitive production.

## Have You a Gold Mine In Your Boiler House?

ELSEWHERE in this issue is an article on the "Relation of Boiler House Equipment to Plant Economy," by Theodore Maynz, that brings to mind the attitude of certain chemical plant executives. When approached by consulting engineers who desired the opportunity of improving the efficiency of what were obviously wasteful boiler plants, the reply ran somewhat as follows: "Our boiler plant expense represents only 10 per cent of our operating costs, so if you save us 10 per cent there it represents only 1 per cent of the total. What we are interested in is the saving of 10 per cent of our production costs. Show us how to do this and we will talk business. The other is too unimportant for us to bother with."

Such a saving does seem unimportant, but in reality it is not. Coal expenditures in a given plant may be cut down by proper engineering in the power plant to such an extent that several thousand dollars annual saving is effected over the expense necessary with poor operation. While this sum may be only a small fraction of the total cost of operating the whole plant, still if it can be made, as it generally can be, with little or no capital cost, it is certainly worth going after. We believe that no one can afford to neglect the possibilities of saving held out by good boiler plant engineering.

## Diatomite As a Lubricant in Concrete

THE RAPID extension during recent months of the use of diatomite in concrete mixtures is significant of a growing recognition of the fact that segregation after mixing and before placing, under ordinary circumstances, is a common occurrence. An extremely small proportion of diatomite has been found effective in preserving the uniformity of the sand and rock distribution in the mix. Concrete with such an addition retains its physical character until placed, even if delivered by means of launder or chute. Less water is required than is ordinarily necessary to insure satisfactory flow, and ultimate strength is thereby enhanced. If the mixture is being delivered by air pressure, or by

"gun," the improvement resulting is particularly marked. The diatomite doubtless aids in the transmission of jars and movements that assist even packing.

The addition of finely divided silica to a concrete mix is by no means a new development. Information published a quarter of a century ago seemed to show that an improvement in the quality of the concrete resulted; and it is not difficult to explain this by drawing attention to the fact that voids are thereby lessened in magnitude, and greater bonding effect secured. Tests have also shown that the addition of clay may improve the quality of the concrete; and lime has been used extensively to insure what is known as workability. Recent results, however, seem to indicate that diatomite, per unit of weight, gives results that are superior to those obtainable by the use of either clay or finely divided crystalline silica. The diatomite, of course, is a type of opaline silica—a colloid in gel form.

The theoretical aspect of the matter has been complicated by an over-reliance on experimental data. Conditions prevailing in laboratory tests are seldom duplicated in practice, and many correcting factors must be considered before a true interpretation can be made as to the value of any of the addition materials commonly used. Laboratory tests of concrete are of value mainly for comparison with other tests of a similar nature, not as a definite indication of what will happen in practice. As a matter of fact, the addition of diatomite may result in so great a general improvement of the concrete, by increasing workability and maintaining the ideal distribution of coarse and fine constituents, that a slight decrease in strength is more than counterbalanced by these favorable factors. This interpretation would assume that an additional surface, of inert material, had been added, which needed bonding without the addition of more cement than is ordinarily used.

One school of engineers, however, considered that an important result in the use of diatomite is the formation of silicate of lime. This hypothesis appears to have been disproved by expert laboratory diagnosis, using the X-ray method. Photographic evidence, however, indicates that the addition of diatomite may result in an increase in the amount of normal bonding crystal structure. Further research is needed to demonstrate the precise nature of the chemical change occurring, if any; but in any event the interpretation of result should take into consideration the obvious advantage of admixture, from the physical standpoint—an advantage that is not always readily discernible in laboratory tests of the usual character.

## Second-Hand Equipment Must Be Carefully Selected

RESULTING largely from the over-expansion of the chemical engineering industries during the World War, there has been available in recent years a large quantity of second-hand plant equipment. Many manufacturers have taken advantage of this fact to procure needed machinery for new plants or for increasing the size of existing plants at a lower cost and with quicker deliveries than would be possible if new equipment were purchased.

Such a practice is generally advantageous to the manufacturer and incidentally has its advantages for the producer of the equipment. For if a plant installs a certain make of second-hand equipment and finds it satisfactory it is more than likely to standardize on that design.

Such second-hand equipment must, however, be suited to the work that it is called on to do if the purchaser is to be so well suited with it that future orders for either the second-hand dealer or the equipment maker are to be forthcoming. This makes it imperative that the purchaser of second-hand equipment select the material purchased with the same care that, from an engineering standpoint, would be used in the purchase of new equipment. There are three factors interested in seeing that second-hand equipment is purchased and used correctly: The seller, the purchaser and the maker. It will be a big step forward when they cooperate toward this end.

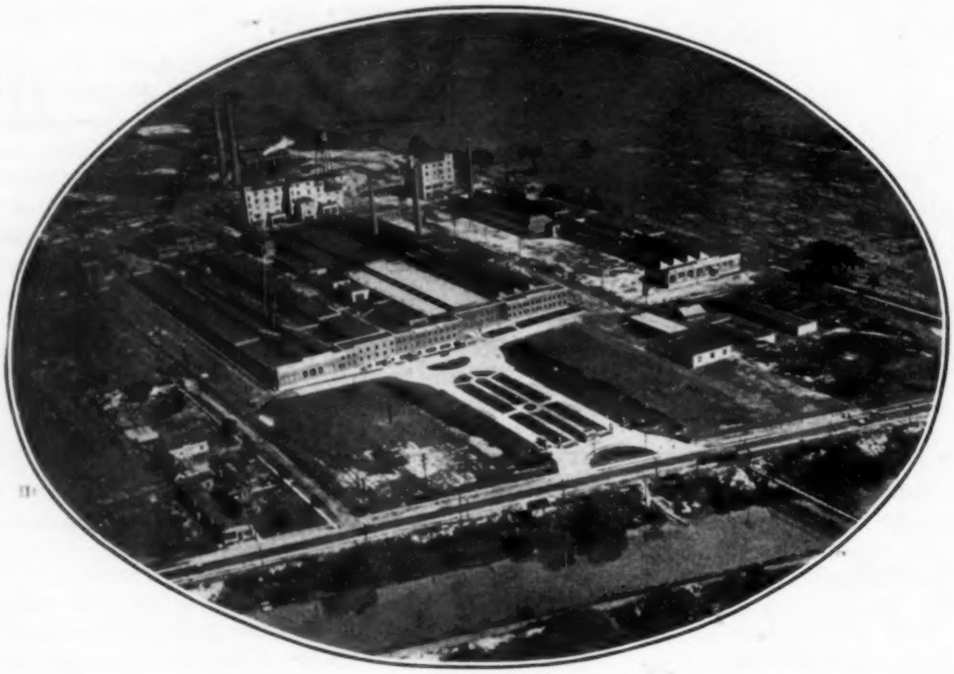
## The Plant Laboratory— Shack or Building?

ON A RECENT visit to industrial plants a number of plant laboratories were inspected. The extremes in management attitude toward this vital part of the works were noted just a few days apart. In one works, which by the way was operating at only 40 per cent capacity, the laboratory consisted of two dirty rooms, with rough board furniture and a couple of broken chairs. It was a shack that remained from the days when the plant was being built, apparently the construction shanty where the erection foreman had had his office.

Another works of about the same age, which incidentally was being doubled in capacity after only three years of operation, presented quite a different appearance. Here a special building had been erected with the first floor for plant instrument room, and the second floor for the control laboratory. This building was as fine a brick structure of the factory type as any other works building. The laboratory space was suitably sub-divided. The windows were large and clean; the floor covered with a suitable bituminous coating. Both physical and chemical apparatus were suitably mounted and the most modern types of needed facilities were available to the group of six or eight college graduates who made up the laboratory staff.

The first plant with its lone and rather despondent chemist in his construction shanty was probably getting value received. The second was getting fine operating efficiency throughout, a result hardly possible without its exact laboratory control. It is probably only a coincidence that the poor laboratory went with forty per cent operation and the fine laboratory was in a plant which was being doubled in size. But even such coincidences sometimes have their significance.

If a laboratory is worth having, and no chemical engineering industry should be without one, it should be properly housed, reasonably equipped and efficiently manned. A poor laboratory may be worse than none at all; certainly sloppy results can be expected from such a place and these results are usually costly if not fatal to successful plant management. Better a skilled plant operator with his rule-of-thumb control than poor laboratory results that only deceive. One error due to poor working conditions may cost more than a whole year's maintenance of a good laboratory.



*Aerial view of the plant of the du Pont Rayon Company which lies along the Erie Canal and the Niagara River at the outskirts of Buffalo, N. Y.*

# *Rayon—The Chemical Engineer's Contribution to the Textile Industry*

*One of the chemical buildings showing a type of reinforced concrete construction that is fast becoming standard in modern chemical plants*

*Lower floor in the chemical plant where the cellulose xanthate is dissolved to form the viscose solution that is later spun into the finished rayon*

*One of the tunnel driers in which the skeins of rayon are dried, cooled and brought to standard moisture content*

*View of the throwing room in which the parallel fibers of rayon are ingeniously twisted into the finished thread*

## A New Chemical Engineering Industry

# Manufacture of Rayon—Chemical Textile

### Operations at the Modern Plant of the du Pont Rayon Co. Present An Unusual Combination of Chemical Engineering Production and Ingenious Mechanical Processes

**By Sidney D. Kirkpatrick**
Associate Editor, *Chem. & Met.*

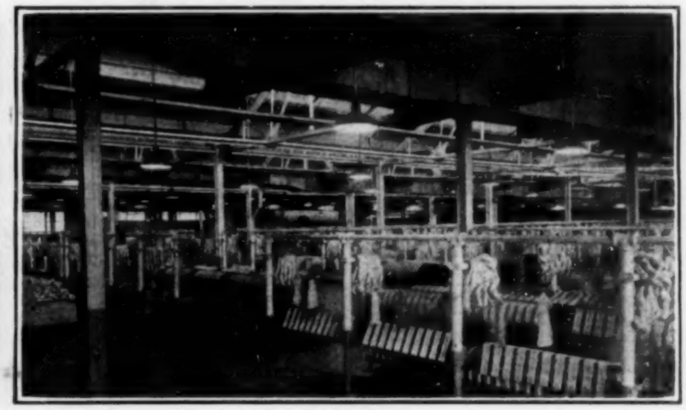
ONE OF THE MANY MYTHS that need exploding is the general belief of the layman that man can never improve upon Nature. As a matter of fact, this is and has been the chemist's job for many years. Sometimes the objective is accomplished by reproducing synthetically the identical material, and incidentally improving upon it by making a more uniform product and of higher quality, as in the case of synthetic indigo. Othertimes the research is rewarded with a new material of radically different composition, yet possessing characteristics that make it even more valuable than the natural product. Witness the synthetic resin Bakelite, for example, that opened up an entirely new field of usefulness. Another such man-made material is rayon—once miscalled artificial silk because certain of its qualities rivalled those of the ancient and queenly textile.

Lately there has come the realization that rayon, because of other of its characteristics, has an individuality of its own that entitles it to separate and distinctive recognition. In 1922, rayon became third among textile fibers, for the world's output in that year for the first time exceeded that of silk. Since then both fibers have gone ahead at a tremendous rate, yet in 1923 rayon, with an output of 97,000,000 lb., held the lead by 10,000,000 lb. over its natural rival. The curve of its production during the past ten years indicates conclusively that rayon is yet to reach its ultimate commercial development.

Rayon production must of necessity be on a large scale. It is a combination of chemical and textile manufacture calling forth the best technology of each industry. The chemical engineering of its production is basic in that a delicate and extremely accurate control of quality is absolutely essential. When the solution leaves the chemical plant to be spun into fiber and thrown and reeled into its various textile forms, its chemical characteristics determine its strength, quality and appearance. If there has been the slightest variation from standard in any one of a half dozen operations, the solution may be rendered entirely useless for its subsequent fabrication into fiber, yarn or finished textile.

Therefore, the enviable background of chemical engineering technology and resources which the du Pont Co. brought to the rayon industry was a most desirable asset. From the French companies, with which the chemical manufacturers were associated in forming the du Pont Rayon Co., there came an experience dating back to the first artificial silk plant established by Chardonnet at Besançon in 1891 and sharing, directly or indirectly, in the development and improvement of all of the commercial processes for producing this material. The establishment of the plant at Buffalo, therefore, and the very recent expansion of the company's activities to Old Hickory, Tennessee, would seem to establish beyond a doubt that basically rayon is a chemical engineering industry.

The site selected by the du Pont Rayon Co. for its first plant was a 125-acre tract on the peculiar plain formation that lies along the Erie Canal and the Niagara River, almost at the edge of the city of Buffalo. From the aerial view on the opposite page will be seen the attractive layout of the buildings. The power plant, water-filtration unit and the storage buildings are in the back-ground, where rail connections provide convenient transportation of supplies and raw materials. The 5-story, reinforced concrete building for chemical production is next, and in front of it are the saw-tooth structures in which are carried on the various textile operations. Offices and laboratories are in the fore-



**Reeling Machines that Transfer the Rayon from the Spools to the Skeins**
The elaborate network of ducts that covers the ceilings of these rooms gives an idea of the attention paid to air conditioning and humidity control.

**Final Inspection of Rayon and Sorting Into Grades**
In order to maintain highly standardized conditions this work is carried out under constant artificial illumination.

ground. At the right, paralleling the rayon buildings, are those of the subsidiary company, the du Pont Cellophane Co., in which is manufactured the unique cellulose product that has in recent times been developed as a transparent wrapper for cartons, and for many other purposes. (See *Chem. & Met.* April 7, 1924, p. 548.)

Of the four commercial processes for making rayon: (1) nitrocellulose, (2) cupro-ammonium, (3) cellulose acetate and (4) viscose, the last named has overshadowed the others in importance, and today at least three-quarters of the world's production is made by this method. The viscose process, as used by the du Pont Co., consists of the following steps:

(1) Treatment of wood pulp with caustic soda to form alkali cellulose.

(2) Transforming alkali cellulose to cellulose xanthate by reaction with carbon bisulphide.

(3) Preparation of the viscose liquid by dissolving the xanthate in water or dilute caustic-soda solution.

(4) Spinning viscose into thread and subsequent hardening by chemical reaction.

(5) Bleaching, drying, reeling, throwing and other textile operations.

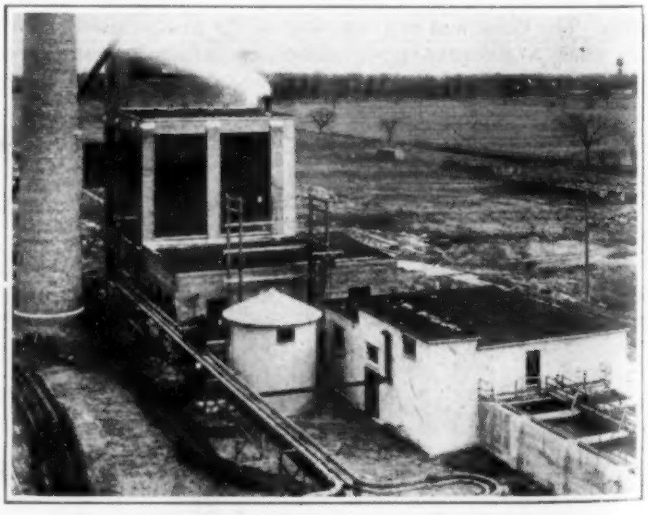
## From Wood Pulp to Xanthate

Sulphite pulp is the source of cellulose, and, therefore, the chief raw material of the viscose process. It possesses the advantage of availability in practically unlimited quantity and, what is equally important, is cheaper—perhaps by half—than any form of cotton. At the du Pont plant domestic and Canadian wood pulp are used in about equal proportions. The first manufacturing operation, which begins on the top or fifth floor of the chemical building, is sometimes called "mercerizing," for it consists in immersing the squares of pulp in a 15 to 20 per cent solution of caustic soda for a period of an hour or more. This transformation of the pulp to alkali cellulose is accomplished in equipment that combines the alkali soaking with a mechanical pressing in order to force out the excess of alkali once the reaction is completed. The individual squares of pulp are supported vertically in a cast-iron trough between leaves or plates similar to those of a filter press.

The treated squares of alkali cellulose are dropped through a chute in the floor below where they are disintegrated by swiftly revolving knives in Werner & Pfleiderer beating machines, known in the industry as "pfleiderers." The process is called "crumbling," because the alkali cellulose is removed from the machines in the form of crumbs. These are dumped into galvanized iron containers and are stored in this condition for some time at constant temperature.

Perhaps the most interesting single step in the process is the transformation of the white crumbly alkali cellulose to the plastic orange-yellow cellulose xanthate. The reaction is with carbon bisulphide and is carried on in large, slowly revolving churns which are known in the industry as "barrates." After a charge of alkali cellulose is put into a churn, the lid is securely screwed down and a measured quantity of carbon bisulphide is pumped in under pressure. The reaction requires 2 to 3 hours for completion. Suction is applied before the churn is emptied in order to remove the excess of carbon bisulphide vapors. These are not only highly flammable and capable of forming explosive mixtures over an extremely wide range, but also are so poisonous as to have marked physiological effect on the workmen should the vapors be allowed to escape into the atmosphere. Every precaution is taken, therefore, to maintain pressure-tight equipment, and extreme care is exercised in all stages in the handling of the carbon bisulphide.

The gelatinous mass of cellulose xanthate from the barrates is dumped through chutes to the battery of mixers in which the water solution of proper viscosity is made. The mixers are shown in one of the accompanying illustrations. Just enough alkali from preceding operations has been left in the product in order to make it readily soluble in water, although sometimes a dilute alkali solution is used as a solvent. Before the viscose solution can be used, it must be aged or "ripened" by storage in steel tanks held at a slightly lower temperature. This process is in reality a chemical reaction during which the cellulose xanthate (more correctly sodium cellulose xanthogenate) gradually loses some of its sulphur to yield a product containing a relatively high proportion of cellulose. The viscose solution is pumped from the ageing tanks through plate-and-frame filter presses which remove any undissolved cellulose xanthate, dirt or insoluble impurities. In a sense, this completes the strictly chemical phase of the manufacturing process, and from here on the textile operations of spinning, throwing and reeling hold the stage. To be sure, in all of the latter operations there



**Power Plant and Water Filtering and Treating Plant**
Water is an essential raw material in rayon production as is evidenced by a consumption at this plant of more than 5,000,000 gal. per day

is chemical control and the maintenance of proper temperature and humidity conditions. Furthermore, such operations as bleaching and drying are essentially chemical and chemical engineering processes, so in reality the work of the chemist does not end with the preparation of the viscose solution.

The filtered viscose solution is pumped to the spinning machines—ingenious combinations of automatic machinery and chemical process equipment. Essentially it is a chemical reaction that takes place in the spinning process, for the viscose liquid is extruded into a hardening solution of acid that reverts the cellulose xanthate to cellulose, which takes the form of a soft solid or gel.

In the spinning machine, the viscose solution, under a pressure of about 100 lb. per sq.in., is forced through minute orifices in a platinum die, called a spinnerette. The diameter of these openings (0.002 to 0.005 in.) determines the size of the filament and together with the number of orifices determines the denier (weight in grams of 9,000 meters) of the yarn. The small gear-type extrusion pumps attached to each spinnerette form one of the most important cogs in the spinning machine, for unless their operation is at a fixed rate, maintaining a constant pressure, the extruded product will lack uniformity in size, weight and appearance.

The freshly formed fibers of the semi-gelatinous viscose pass through the spinnerette into the hardening bath, where the alkali is neutralized. During the early days of the industry, many patented compositions were proposed for this precipitating bath, but experience has demonstrated that a simple mixture of dilute sulphuric acid and niter cake is satisfactory for this purpose.

At the du Pont plant the spool spinning method is employed; the parallel filaments are drawn through the acid bath and immediately wound on a drum-shaped glass cylinder about 6 in. in diameter and 10 to 12 in. in width. After a definite quantity of fiber, determined by the time and rate of spinning, has been wound on a glass drum, it is removed and transferred to the washing racks where a stream of water washes out the excess of acid. The drums are placed one above another on the rack and receive the equivalent of counter-current washing, for as the wash is completed each drum is raised in position so that the final washing is with pure water. The lowest bobbin on the other hand is washed with the water that has passed over all of the upper rows. As the washing process is completed, the cylinders are removed and placed on special trucks that are drawn through Proctor and Schwartz tunnel driers. This completes the processing of the fiber while still in the form of separate filaments. Next, because the glass cylinders are inconvenient in handling, the rayon is transferred to wooden spools or bobbins. Then, in order to give the parallel strands the necessary twist for good wearing qualities, the bobbins are transferred to the throwing machines. The desired twist is accomplished by the simple expedient of rewinding the thread on another spool revolving at a greater speed. This difference in rate of rotation determines the twist of the thread.

Reeling the thread into skeins is the next textile operation and is carried on with the automatic machinery shown in the illustrations. The skeins, each containing 3,000 yards of rayon, are transferred from the reeling machines on heavy glass rods and in this form pass through the final operations of finishing, inspecting and packing. Finishing consists in bleaching with chlorine, if the bleached product is desired, and washing with water to remove any impurities and to improve the luster. The skeins, still held on the glass rods, are carried into the traveling drier which, through automatic control of temperature and humidity, first dries the rayon, then cools it and finally, by the addition of a slight amount of moisture, delivers the final product with its standard regain or moisture content. The inspection is done in special rooms under constant illumination. The rayon is sorted into the A, B, C, and inferior grades (determined principally by the appearance of non-uniformity, broken ends and similar faults that are not entirely avoidable) and is weighed into packages containing exactly 10 lb. each. These are then wrapped in pasteboard and wrapping paper, packed in wooden boxes of 220 lb. for shipment to the dyers, throwsters and other textile fabricators.

**Excellent Facilities Are Maintained for Chemical and Physical Testing of Rayon Products**

Tensile strength, denier and weight are determined on the standard textile testing apparatus shown at the right. The chemical laboratory at the left is one of the research units in the cellophane plant.

The power plant that supplies the process steam, electric power and heat for all of the manufacturing requirements is shown on page 846. The plant houses seven 525-hp. boilers. Its average electrical load is 1,500 kw. The refrigeration plant, with an average daily output equivalent to 90 tons of refrigeration, supplies brine and cold water for the exceptionally large installation of air conditioning and humidity control equipment which was built by the Carrier Engineering Co. and W. L. Fleisher & Co.

For the privilege of visiting the plant of the du Pont Rayon Co., and for much of the information regarding its manufacturing processes, the writer is indebted to its president, Leonard A. Yerkes, to M. du Pont Lee, production manager, and to Ernest B. Benger, chemical director.

# Electric Power Supply of the Future for Chemical Industry

## A Discussion of the Relation Between the Economic Use of Hydro-electric Power Developments and the Extension of Electrochemical Manufacture

By R. S. McBride
Assistant Editor, *Chem. & Met.*

PUBLIC utility companies, electrochemical industries, and other industrial power consumers are competitors for primary hydro-electric power. Constantly and rapidly increasing demand for this power means ever renewed threat of shortage. Such shortage of only a few per cent below the demand may bring competitive bidding and abnormally large percentage increase in rates.

Under these circumstances it is vital for the electrochemical and electrometallurgical industries to take account of the present trends. No definite conclusions regarding any specific case can be drawn without a careful study of all of the circumstances concerning it. But certain generalizations, especially those relating to basic economic principles, are useful.

Three types of chemical operations are carried out by use of electrical energy which cannot be so well done in any other way. These are:

1. Manufacture of electric furnace products requiring extremely high temperatures.
2. The electrolytic production of chemicals not as readily or as cheaply produced by other means, such as chlorine and caustic soda.
3. The electrolytic refining of metals which cannot be successfully raised to high purity by other means.

These three groups are legitimate users of water power. In fact for these three types of industry such energy is vital to success. Moreover, the products made in electric furnaces are essentials of peace-time industry and military preparedness which cannot be manufactured by any other means. And many of them are as important as nitrogen, both in peace and war time. This does not mean that these industries are the only ones legitimately to be supplied, or that they should get any special priority in water power supply. But perhaps they stand on a somewhat higher plane in power requirement than some other groups.

Some of the other important conditions under which hydro-electric energy is useful for chemical processing can be enumerated. The extent to which these enter in determining whether water power or fuel will be employed vary widely as between industries and between different localities. The more of the factors which enter the more likely it is that water power will be used. The principal, though by no means all of the important factors, of this nature which affect the use of water power in industry are:

(a) Availability of off-peak water power from public-utility systems.
(b) Availability of seasonal water power not suited to public-utility use.
(c) A surplus of water power from newly established plants.
(d) The location of a water power project at a considerable distance from existing industrial or municipal centers. (This is really a special type of surplus.)
(e) Energy requirement for special heating operations in which very exact temperature control or process control from a distant point is important.
(f) Energy requirement for heating a small part or area in which intensive electrical heating elements may be more readily used than any other type of heat.
(g) Heating requirements where the presence of products of combustion are objectionable, especially cases where steam or indirect heating are not readily employed.
(h) Cases where fire risk in hazardous processes may be reduced by electrically heated instead of fuel-fired devices. Steam is usually preferable to either electricity or fuel under such circumstances.

It is obviously impossible to weigh these various factors as to their relative importance. But it is also evident that the more of them which favor hydro-electric power in any given case the greater the likelihood that this energy will be used for industrial chemical purposes. The correct measure for determining these matters is found in the actual cost per unit of product made. That energy source which enables the cheapest over-all manufacturing result, considering cost of the energy, quality of the product, the spoilage or scrap created, and all other factors, is the one that should be employed.

Existence of extreme cases in which isolated hydro-electric plants are far removed from industrial or municipal power-using centers must not be allowed to disturb the industrial perspective. Under those circumstances electricity properly finds application even for low-temperature heating and other uses which might equally well, from a technical point of view, be done with fuel. Such examples are, however, not numerous nor typical; they should not lead chemical industries into making developments based upon low electrical energy cost unless it is very certain that these prices can be continued for the period requisite for financial success of the project as a whole.

The laws of supply and demand might be expected to govern prices for water power. As a matter of fact, however, public-utility regulation by state and federal authorities changes the situation, because in general the price charged depends upon the cost of operation and the requisite return upon investment, rather than upon how much prospective users will pay. As a result the following conditions must be recognized:

(a) The price charged by public-utility companies depends upon the cost for the power from existing plants and needed new developments.

(b) The distribution to various classes of customers is determined largely by the type of rate schedule which public authorities fix.

(c) The law of supply and demand determines whether new developments will be made, either by public-utility companies or for private power projects. These developments usually are made only as the prospective price or industrial value of the power can be shown to justify the new investment.

(d) There is no recognized system for giving priority to one class of customers over another, either from existing properties or in the right to develop new power projects. Usually the only priority recognized is that of previous use.

In considering electrochemical industries and public-utility companies as competitors for available power supply one must limit the discussion largely to hydro-electric developments. Usually when steam-electric power is employed there is little difficulty in getting adequate power for all who can afford to pay the price. And, too, the electrochemical industries have not yet reached the point where they can afford to pay for this steam-electric energy. They are, therefore, only concerned in the policy which will determine the utilization of all big water power developments.

### Industrial vs. Public-Utility Loads

The industrial chemical user of power usually wishes to take current 24 hours a day 365 days in a year. In fact, to make a success of his business he usually has to operate on as nearly as practicable a continuous basis. A group of such companies, with its diversity in loads and in causes of interruptions, may use power at an average of 90 per cent of full capacity, even though single companies in the group may reach only 60 to 75 per cent capacity load factor. On the other hand the city distributing system usually works at an average of only 40 per cent load factor. A simple comparison under these conditions as to the real cost of the energy is quite illuminating.

Let us take, for example, the hypothetical case of a hydro-electric plant which can profitably sell current at the bus-bar for 3 mills per kw.-hr. (about $20 per hp.-yr.) if operating continuously. Such a plant would probably find that 90 per cent of the total cost of the power was in capital charges and 10 per cent in operating expenses. Hence, if the electric-furnace and electrochemical industries, which might function on a 90 per cent load factor basis, were to take the current the average price would have to be 3.3 mills. If a nearby public utility company were to take the power on a 40 per cent load factor basis the price would be over 7 mills. Thus the public utility, because its customers use current less than half the time from a plant of large investment, would have to pay more than double as much for generating the energy which they did use. Distributing and other expenses are in still higher ratio. The idle time would represent a loss of market and hence no income to compensate for the ever-continuing capital charges.

If it happened that steam-electric energy could be generated and sold profitably at 6 mills per kilowatt-hour on a 100 per cent load factor under such local conditions, it is interesting to see what increase in cost to the user would come from a lower load factor. It is likely that 80 per cent of the 6 mills would be for operating expense and only 20 per cent for capital charge. Hence at 90 per cent and 40 per cent load factors the total price (based on costs) would be about 6.2 and 7.8 mills, respectively. Thus for city distribution the price need be only a little greater for steam-electric than for hydro-electric power immediately around the hydro-electric plant; but for long hour users the prices are about two to one.

### Effect of Transmission Costs

If the city that was to use the power were at a distance, say 100 miles, from the hydro-electric plant then we should have to add to this price the cost of transmission. This cost would be almost altogether capital charge, though energy loss in transmission would also be a factor amounting to perhaps 10 to 15 per cent. Perhaps it would take only 1.5 mills to carry the energy one hundred miles on a 100 per cent load factor basis, but at a 40 per cent load factor the corresponding transmission cost would be 3.75 mills. Under these circumstances, if the city were a hundred miles from the hydro-electric plant the total cost of delivered electricity at the outskirts of the city would be 11.55 mills, or nearly four times as much as the cost of generation at the dam. Under these circumstances it would be much cheaper to use steam-electric energy generated near the city than to use what was apparently very much less expensive hydro-electric energy taken at a low load factor from a plant some distance away.

These comparisons bring out an important economic principle with respect to the proper use of hydro-electric power. Such power, the cost of which is mainly capital expense, should be used by those able to work on almost continuous basis. Another Niagara Falls used at 40 per cent load factor, instead of 90 per cent as now, would be a gross economic waste. Moreover it would represent an actual extravagance in the way of cost per kilowatt-hour to the power user, because energy that now sells on the average of less than $20 per horse-power year would cost municipal distributing systems having low load factors several times this figure, in fact more than the energy would cost if generated in a modern steam-electric plant near the distribution center.

### Dissipating Hydro-Electric Power

The energy from great hydro-electric developments certainly should not be dissipated on any low load factor distributing system. Its great economic advantage of low cost must not be destroyed by transmitting the power long distances and building up great transmission costs that make it both unavailable for electrochemical or electric-furnace use and of unduly high price for general industrial use. The best interest of the country, even the electric customers alone, would not be served by such a plan.

Moreover, such power should not be wasted on miscellaneous industrial uses which might equally well be carried out in fuel-fired furnaces. If suitable precautions are not taken it will be utterly impossible to continue the production at reasonable prices of those products which can only be made at relatively low cost by means of electrical energy. These uses deserve, and for the general good should have, first call on certain hydro-electric power because their use of power is practically continuous.

We shall hope for the keen appreciation of these various facts by the state and federal commissions which deal with power company affairs and by the technical experts who will co-operate with them. It is important that a similar recognition of these principles

be accorded by the chemical engineering profession. As chemical engineers we should recognize as a duty:

(a) The planning of power use to afford a high load factor in order that the chemical industries may remain preferred customers.
(b) The manufacture of highest practicable quality of products with electric energy.
(c) The choice of proper plant locations for most economical power supply.
(d) The need for conservatism in any industrial development which must count upon cheap power for a long time in the future.

It would be very fine if we could anticipate for such electrochemical industries a consideration ahead of other users to whom cheap electricity is not vital; but to count upon such priority will be highly hazardous. Competition is likely to enter and take from electrochemical industries power which has hitherto largely been theirs for the asking. Especially will this be the case if public-utility companies use hydro-electric power for their base-load and steam-electric power only for peak-load supply. Under these circumstances the electrochemical industries will be preferred customers at low kilowatt-hour prices only when they have an exceedingly high load factor, and not always even under these circumstances.

There is a fundamental public policy yet to be determined in these matters. Public officials influenced by the need for shaping these industrial developments to the general good of the country will be the ones to fix upon this policy. They will have to determine whether it is better for the general public welfare to dump into a power pool the hydro-electric energy, which is very economical at its source, or to segregate this energy for nearby industrial use. If the former policy is accepted it will lower very slightly, if at all, the average delivered cost of energy to the general public. If the latter policy is adopted it will conserve and perpetuate the electrochemical industries in low-cost manufacturing and thus contribute importantly to a lowered cost of living.

For the present it is impossible to say which way the trend will be. But in either event, the chemical industries can expect consideration only to the extent that they render a superior public service with the energy supplied. The task ahead, therefore, is to make the most efficient possible use of hydro-electric power in every class of electrochemical and electric-furnace operation. This is a task of importance which will well reward the ablest chemical engineers who are available to attack the problem.

# Lazote Plant to Have Output of 25 Tons of Ammonia

**du Pont's Nitrogen Fixation Plant Is Expected to Be Ready for Operation by February, 1926**

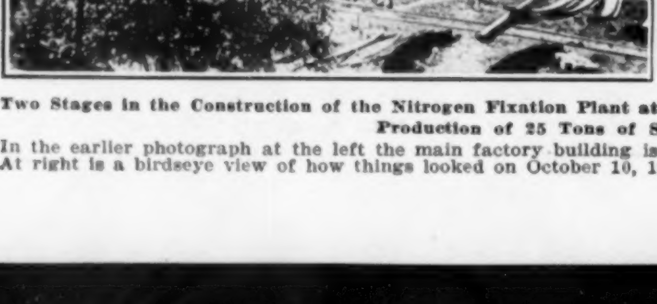
THE interest of the du Pont Company in obtaining a nitrogen supply from the air has been continuous for many years, culminating in the obtaining of the American rights for the manufacture of synthetic ammonia by the Claude process. To exploit this process, Lazote, Inc., has been formed, and at Belle, West Virginia—about ten miles southeast of Charleston, West Virginia—the company is building a plant with a capacity of approximately 25 tons per day of anhydrous ammonia.

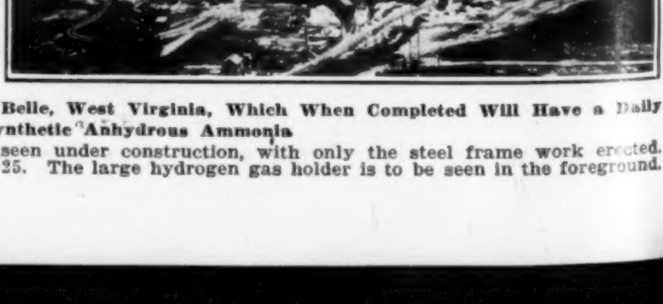
The water gas plant at Belle will have a capacity of 8,000,000 cubic feet per day. It will differ from the ordinary water gas plant, not only in the fact that the gas will not be carburetted, but bituminous coal will be used as fuel, whereas water gas is usually made from coke or anthracite coal. The plant at Belle will probably be the largest gas plant in the United States built for the manufacture of water gas from bituminous coal.

To obtain nitrogen, it is only necessary to burn a portion of the hydrogen produced from the water gas in a burner with a supply of air, the oxygen in the air combining with the portion of the hydrogen to form water, leaving behind nitrogen. These gases are then mixed in the proper volume proportion—75 per cent hydrogen and 25 per cent nitrogen—and the mixture is subjected to high pressure, approximately 1,000 atmospheres or 14,700 lb. per square inch.

The gas under this high pressure then passes to a purification tube, in which, by the action of a catalyst and at a somewhat elevated temperature, any carbon monoxide remaining in the gas is converted into methane, the presence of which in the succeeding synthesis is not detrimental to the action of the catalyst. After the purifying operation, the gas, still under high pressure, passes successively through a series of tubes, in which the temperature is increased to approximately 1,000 deg. F. and it is subjected to a catalyst. Due to the high pressure, high temperature and the catalyst, a portion of the nitrogen-hydrogen mixture in each tube is converted into ammonia. This is condensed and drawn off as pure anhydrous ammonia.

Extracts from an article prepared for the *du Pont Magazine*. The accompanying photographs were supplied through the courtesy of the du Pont Engineering Company.





**Two Stages in the Construction of the Nitrogen Fixation Plant at Belle, West Virginia, Which When Completed Will Have a Daily Production of 25 Tons of Synthetic Anhydrous Ammonia**

In the earlier photograph at the left the main factory building is seen under construction, with only the steel frame work erected. At right is a birdseye view of how things looked on October 10, 1925. The large hydrogen gas holder is to be seen in the foreground.

# Relation of Boiler House Equipment To Plant Economy

## Industries Using Steam in Process Work Have High Load Factor and Can Afford to Equip for Most Economic Operation

By Theodore Maynz
Consulting Engineer, Shaker Heights, Cleveland, Ohio

WHY is it that an efficiently operated industry that requires a boiler plant sometimes regards it as a necessary evil, neglects it, tries to forget it, and will not maintain it properly? In organizations where each department is managed as if it were a separate business, where it requires six signed slips of various colors to obtain two pieces of emery cloth, the boiler plant is shunned as if it were a pariah.

If a boiler plant is necessary, it is not an evil. If it is not an evil it does constructive work. If it does constructive work it should show a profit. And it can only show a profit if it is operated intelligently, managed efficiently and maintained adequately.

Executives should realize that a boiler plant has a definite earning capacity, and that it must produce these earnings above its interest, and investment charges. Heat in the form of steam is a purchasable commodity, just like calico, wheat or bonds, and its price depends on the same economic laws of cost of production, supply and demand, as any other article.

In most large cities, steam can be purchased from central stations at a definite price. Due to the high cost of transmitting apparatus, its distribution is extremely expensive and therefore most factories, office buildings, etc. must purchase the equipment and manufacture it themselves. Under these circumstances, it is necessary to produce steam at a reasonable cost, compatible with the service requirement, purchase and install equipment suitable for the service and to operate the plant so as to give this service.

The requirements of a boiler plant can be divided in three main items as follows:

1. Power
2. Process Steam
3. Building Heat

Of course, in this country we always need building heat for a portion of the year, so that both power and process service are coupled with heat, but the above classification is by importance to the industry.

In the first class we have a definite guide to gage the efficiency of our plant. If power cannot be produced as cheaply as it can be purchased, we have no right to manufacture it ourselves.

In the second and third classes, unless central station steam is available, we have no definite price with which to compare the cost of this service and to tell whether we are producing steam at a cost low enough to be compatible with the economic purchasing of this service. There are, however, guides that tell how close we are to the economical production of heat.

First of all, we must be able to know what we are doing before we can hope to improve conditions. We must know our "evaporation" within reasonable limits of accuracy. There are on the market at present very reliable and accurate meters the cost of which is extremely nominal. With this as a basis, the coal purchased and its price known, all we need is a little accounting to change the plant from the "by guess" class to one in which the "cost per 1,000 pounds" is an accurate figure. After we have accounted for wages, supplies and repairs, we can set up accounts for the fixed charges on equipment and building space, and then we are in a position to know just what the steam costs.

Having a definite idea that the boiler house is a necessary economic unit for production, we must decide what type of equipment we ought to have for the work to be done. For the first two classes of work, power production and process steam (or a combination of both), our boiler plant must have equipment that is absolutely reliable and of high economy. Power production is usually a 24-hour proposition and process steam is also, as a rule, 24-hours—365 days per year in use, so that we have a comparatively high load factor to earn the investment charges. Under the above circumstances, the apparatus must be absolutely reliable and sufficient stand-by apparatus installed to allow the operating force to maintain their equipment for this type of service. Such a plant should have at least three boilers, any two of which will carry the load without excessive ratings. Boiler feed pumps should be in duplicate, draft apparatus so arranged that any unit can be taken out of service for repair, and the ash and coal handling apparatus so arranged that their failure will not put the plant out of operation. This means either duplication of handling equipment or sufficient bunker capacity to serve the plant for long periods. Very often the combined coal and ash conveyor in a high duty 24-hour plant breaks down and by the time it is repaired and again in service, it is difficult to determine what to do first, whether to fill the empty coal bins or clean out the blocked up ash basements and hoppers.

### Accessory Equipment Needed

Of course, the boilers should be equipped with adequate stop and non-return valves, soot blowers, flow meters and $CO_2$ recorders, draft gages and flue temperature recorders, or boiler meters equipped with the above apparatus. Automatic stokers, or pulverized coal equipment, of a design adequate and suitable for the work to be done, must be installed. Hand fires have absolutely no place in a 24-hour plant for power or process steam production, even with cheap coal. With a 24-hour high load factor use, the recovery of waste heat from the stack gases by means of economizers or air preheaters is a dividend paying proposition; and superheaters for use with steam turbines are not only thermodynamically correct, but also from a turbine

maintenance standpoint, save more than their installation costs.

However, just because a boiler plant is equipped with all of these aids, does not mean that it is basically correct. The apparatus may be chosen so blindly, and the combination resulting be so incongruous that it is money thrown away. A flue gas thermometer, installed at one point of the flue, instead of over the entire width, is useless. A $CO_2$ recorder with a sampling tube in a dead gas pocket can never be satisfactory. An automatic stoker of the wrong type is a constant source of expense and dissatisfaction. Often high economy feed pumps are installed, only to have them inoperative a large portion of the time due to working under water conditions for which they were never intended. Numerous examples could be quoted where the design and use of incorrect apparatus made an apparently excellent boiler house an unsatisfactory ensemble and an expensive investment. Such a plant, even with an excellent operating force, will never adequately perform its duties.

Boiler plants of the third class as a rule operate with a low load factor, 10 or 12 hours per day active, and 6 or 7 months per year in full use. These cannot afford anything but the simplest and most inexpensive apparatus that will perform the work, even though the steam demand during operation is large. Hand fires, hand lance flue cleaning, a cheap water meter and simple coal handling are all that will pay dividends, and expensive apparatus for high economy is a waste of money, unless fuel is extremely expensive.

### Poor Operation Characterizes Industrial Boiler Plants

The operation of the average industrial boiler plant is a crime. Fifty to 60 per cent boiler efficiency during operation is the rule, even with apparatus capable of producing 70 to 75 per cent overall economy. Expecting a fireman to operate a boiler economically without the proper boiler meters is as bad as expecting him to maintain a constant boiler pressure without a pressure gage. You can't tell the pressure by feeling the boiler nor can you tell how efficient your combustion is without the necessary instruments, or by a broken flow meter and an inoperative $CO_2$ recorder. Too many industrial executives buy their boiler room instruments (if any) through "sales talk," or price quotation, rather than choosing them with a view to the work to be done, the results to be accomplished and the intelligence of the operating force for their use and maintenance. A certain recorder that is giving excellent results and has almost 100 per cent availability for three years in one plant, has never given any service in another, being inoperative for over 95 per cent of the time during the past year. The first plant has an operating force that can and will take care of this instrument intelligently; the second plant should never have purchased this type of instrument because there is no one there who is competent or willing to take care of a "laboratory" type of recorder.

Quite often the inadequate maintenance of a plant is not the fault of the operating engineer, for in one case the plant manager refused to give his engineer a boiler tube cleaner, for fear that it would injure the boiler tubes. Needless to say, these boilers were quite badly scaled and of course, inefficient.

It is rarely that an industrial concern has an engineering force competent to design, build or operate a high duty boiler or power plant, and such a plant should call in qualified engineering talent, specializing in power production, to design their plant for the particular service and periodically inspect it and co-operate with the regular operating force so that it functions properly and is maintained at high efficiency.

### Pipe Lines Are Important

The transmitting machinery for steam power is another item that is usually poorly designed and improperly maintained. The various steam pipes should be designed on a velocity and pressure drop basis, adequate provision for expansion and drainage provided, and heat lines insulated efficiently, so that there is a minimum of heat loss. The finest gasket material will not hold a joint from leaking if the pipe is under expansion strains and even 3-in. thick flanges have been broken in trying to make such a joint tight. A water hammer, always annoying and too often dangerous, will result from inadequately drained lines, while the failure of a piece of apparatus to "cook" the product properly is often the result of too large a pressure drop due to too small lines. The use of 3 in. of high-pressure heat insulation on a line with 25 lb. steam pressure is not as economically wasteful as ½ in. of covering on a 150-lb. pressure steam line, often with flanges and fittings exposed. The misplacing of a trap connection in one case kept about 50 ft. of low-pressure steam pipe with its 4 or 5 radiators, completely out of service. Two hours of labor and 25 cents worth of material put these radiators in operation after they had been useless for several years. The improper draining of another line cracked three radiators in one year, due to freezing under intermittent service.

The use of a proper expansion loop between the boiler and the main cured a "baffling" case of tube failure in the tube sheet of fire tube boilers. In another case it made a remarkable difference in the reliability of a mill drive Corliss engine. Innumerable examples might be quoted showing how improperly designed or added piping has seriously impaired the entire plant efficiency and service.

### Industrial Power Plants Usually Give Cheap Power

Sometimes the plant management realizes that it is costing them more to make their power than to purchase it. The central station figures are compared with their plant coal, labor and supply costs, and the plant is scrapped, the boilers being operated only in winter for low-pressure heat. Very often this is a wise move but more often, with their heating equipment operated even more inefficiently than before, very little, if any, money is saved. In nine cases out of ten, adequate advice on the revamping of their plant would have produced their power, in combination with their heat, at a very much lower cost than the service could be purchased, and probably the revamping would not have entailed much more expense than the change over to purchased power actually did cost.

If an executive considers his boiler plant as a department of the manufacturing process, employs some one with sufficient technical and practical knowledge to design and operate it, spends enough funds on it to maintain it and increase its capacity as the need arises, he will have a boiler plant that pays dividends and gives service, instead of one of the usual "lame ducks" that one sees in industrial plants.

# What Is Your Capital Ratio?

## This Factor Is a Valuable Index to Profits as Well as a Distinctive Characteristic of the Chemical Engineering Industries

By C. R. DeLong

Chief, Chemical Division, United States Tariff Commission

*Editor's Note: This is the first of a series of instructive articles on the economic phases of the chemical engineering industries. In the first of these articles, Mr. DeLong, who for a number of years has had general charge of the Tariff Commission's investigations into the costs of production in the chemical industries, will discuss certain basic relationships that exist between such factors as capital investment on the one hand and value of product, raw material or labor costs on the other. The present article brings out in a striking manner one of the most distinctive economic characteristics of the chemical engineering industries, viz., high capital investment per value of production.*

CAPITAL RATIO means the relation of capital invested in an industry to the value of the products it produces. It will pay every executive in the chemical industries to keep his capital ratio under close scrutiny. This factor is one of the important indicators of the financial stability of a commercial organization, and often close attention to it will have its reward in increased profits. Also, it should be ever present in determining plans for sales drives or before investing capital in additional plant equipment.

You may find, for example, that the cost per dollar of increased sales will be greater than your existing capital ratio. If so, it would be wise to proceed with caution. If this ratio is considered in determining whether or not additional capital should be invested in increasing productive capacity, it should act as a balance wheel to keep expansion within a stable and healthy growth, and to avoid pitfalls of inflation during a temporary boom. Expansion in a temporary boom leaves an industry with a greatly inflated capital ratio and interest on this additional investment must be paid before profits will begin to accumulate.

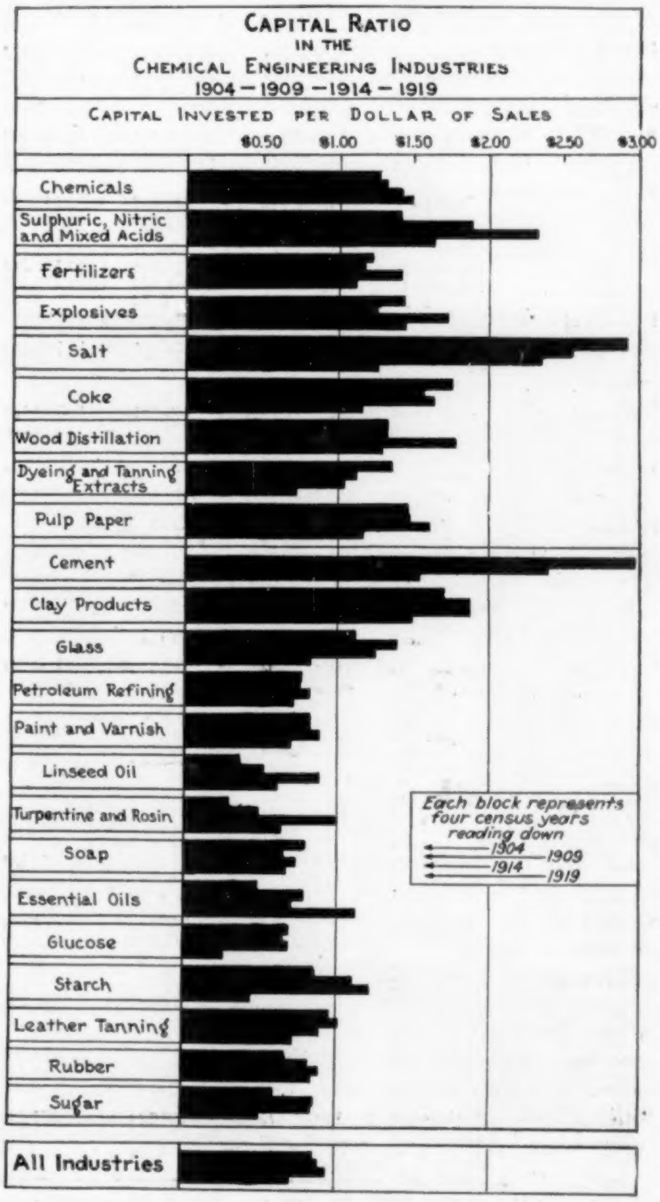
The important question is how may your capital ratio be kept at a minimum or below the average of the industry? Compare your ratio with that of the particular branch of the industry in which your business falls. If you are only at an average, or above the average, a house cleaning of the capital account will undoubtedly reveal idle capital which can be put to effective work. If your ratio is below the average of the industry there are still chances for further decreasing it by a close check of all capital items. It would appear from the accompanying chart that within the strictly chemical industry where the average capital ratio in 1919 was \$1.49, a good goal to set is \$1.00 of invested capital per \$1.00 of sales.

Some of the places where idle capital may be found are as follows: (1) Excessive credits or accounts receivable. (2) Overgrown inventories of both raw materials and finished products. (3) Inefficient utilization of factory space. (4) Inefficient or obsolete mechanical equipment due to poor selection of material or faulty design.



In order to set up a means of comparing the capital ratios in the different industries and to contrast them with the average for all manufacturing, the writer has prepared the accompanying statistical analysis based on the official data published by the Bureau of the Census, Department of Commerce, for the four years 1904, 1909, 1914 and 1919. Figures on capital invested have not been compiled by this branch of the Government service since 1919. It is therefore impossible to compute this ratio for more recent years. These data represent an average of the entire industries, but it is believed that they may also serve as a basis for comparison with the ratios of individual companies.

In making comparisons between a branch of the industry which covers many separate manufacturing operations, and an individual company, allowances should be made for the nature of the business of the particular company. In other cases where figures represent a specific industry, such as fertilizers and paints and varnishes, the figures should be of particular value to individual members of such an industry for comparative purposes. In these cases they afford a direct means by which each company can ascertain whether or not its capital ratio is below or above the average of the entire industry. It should be recognized



that capital ratio constantly changes, due to variations in volume of sales from year to year. Offsetting this are the changes in capital structure due to increased investment in manufacturing facilities, to any tendency toward over capitalization, or to expenditures in order to secure additional sales volume. Aside from these, however, there are some surprising variations among the different industries. One of the most striking is the case of cement, for which the capital invested per dollar of sales has ranged from $1.55 in 1919 to as high as $2.97 in 1914. The salt industry has decreased its ratio from $2.91 in 1904 to $1.27 in 1919. Many other branches of industry in spite of marked industrial changes during this period have shown a very uniform capital ratio.

**Capital Invested, Value of Products and Capital Ratio in the Chemical Engineering Industries, 1904, 1909, 1914, 1919**

| | 1904 | 1909 | 1914 | 1919 |
|---|---|---|---|---|
| Chemicals: | | | | |
| Products | $75,357,495 | $117,741,103 | $158,053,602 | $574,141,030 |
| Capital | 96,764,847 | 155,198,945 | 224,345,921 | 659,480,247 |
| Ratio | 1.28 | 1.32 | 1.42 | 1.49 |
| Sulphuric, nitric and mixed acids: | | | | |
| Products | 9,052,646 | 9,884,057 | 15,215,474 | 31,470,480 |
| Capital | 12,761,920 | 18,726,195 | 35,233,806 | 51,160,004 |
| Ratio | 1.41 | 1.89 | 2.32 | 1.63 |
| Fertilizers: | | | | |
| Products | 56,541,000 | 103,960,000 | 153,196,000 | 281,144,000 |
| Capital | 68,917,000 | 121,537,000 | 217,065,000 | 311,633,000 |
| Ratio | 1.22 | 1.17 | 1.42 | 1.11 |
| Explosives: | | | | |
| Products | 29,602,884 | 40,139,661 | 41,432,970 | 92,474,813 |
| Capital | 42,307,163 | 50,167,976 | 71,351,414 | 133,247,684 |
| Ratio | 1.43 | 1.25 | 1.72 | 1.44 |
| Salt: | | | | |
| Products | 9,437,662 | 11,327,834 | 14,070,333 | 37,513,821 |
| Capital | 25,586,282 | 29,011,793 | 33,151,134 | 47,725,231 |
| Ratio | 2.91 | 2.56 | 2.36 | 1.27 |
| Coke: | | | | |
| Products | 51,728,647 | 95,696,622 | 99,275,020 | 316,515,838 |
| Capital | 90,712,877 | 152,321,337 | 161,561,449 | 365,249,622 |
| Ratio | 1.75 | 1.57 | 1.63 | 1.15 |
| Paint and varnish: | | | | |
| Products | 90,840,000 | 124,889,000 | 145,623,691 | 340,346,803 |
| Capital | 75,486,000 | 103,995,000 | 129,533,935 | 239,775,836 |
| Ratio | 0.83 | 0.83 | 0.89 | 0.70 |
| Linseed oil: | | | | |
| Products | 27,577,152 | 36,738,694 | 44,882,538 | 120,638,100 |
| Capital | 9,849,695 | 18,931,829 | 39,872,712 | 73,954,065 |
| Ratio | 0.36 | 0.52 | 0.89 | 0.61 |
| Turpentine and rosin: | | | | |
| Products | 23,937,024 | 25,295,017 | 20,990,191 | 53,051,294 |
| Capital | 6,961,165 | 12,400,978 | 20,744,872 | 33,595,986 |
| Ratio | 0.29 | 0.49 | 0.99 | 0.63 |
| Wood distillation: | | | | |
| Products | 7,813,483 | 9,736,998 | 9,882,537 | 32,545,314 |
| Capital | 10,506,979 | 13,017,192 | 17,562,849 | 42,334,503 |
| Ratio | 1.34 | 1.34 | 1.78 | 1.30 |
| Petroleum refining: | | | | |
| Products | 175,005,320 | 236,997,659 | 396,361,406 | 1,632,532,766 |
| Capital | 136,280,541 | 181,916,205 | 325,646,120 | 1,170,278,189 |
| Ratio | 0.78 | 0.77 | 0.82 | 0.72 |
| Dyeing and tanning extracts: | | | | |
| Products | 10,893,113 | 15,954,574 | 20,620,336 | 53,744,283 |
| Capital | 14,904,150 | 17,934,545 | 21,283,974 | 38,689,058 |
| Ratio | 1.37 | 1.12 | 1.03 | 0.72 |
| Soap: | | | | |
| Products | 68,274,700 | 111,357,777 | 127,942,441 | 316,740,115 |
| Capital | 54,816,301 | 71,951,109 | 92,871,533 | 212,416,866 |
| Ratio | 0.80 | 0.65 | 0.73 | 0.67 |
| Essential oils: | | | | |
| Products | 1,464,662 | 1,737,234 | 2,313,606 | 5,698,403 |
| Capital | 723,004 | 1,365,438 | 1,616,682 | 6,379,910 |
| Ratio | 0.49 | 0.79 | 0.70 | 1.12 |
| Glucose: | | | | |
| Products | 24,566,932 | 32,930,918 | 38,619,383 | 134,548,109 |
| Capital | 17,045,313 | 21,446,328 | 26,572,403 | 35,104,327 |
| Ratio | 0.69 | 0.65 | 0.69 | 0.26 |
| Starch: | | | | |
| Products | 8,082,904 | 15,868,393 | 13,996,018 | 51,708,151 |
| Capital | 7,007,695 | 17,420,091 | 17,069,940 | 23,078,355 |
| Ratio | 0.87 | 1.10 | 1.22 | 0.45 |
| Pulp and paper: | | | | |
| Products | 188,715,189 | 267,656,964 | 332,147,175 | 788,059,377 |
| Capital | 277,444,471 | 409,348,505 | 534,624,600 | 905,794,583 |
| Ratio | 1.47 | 1.48 | 1.61 | 1.16 |
| Sugar: | | | | |
| Products | 275,285,000 | 327,371,780 | 373,639,298 | 937,883,918 |
| Capital | 165,468,000 | 282,795,499 | 315,677,669 | 473,242,631 |
| Ratio | 0.60 | 0.86 | 0.84 | 0.51 |
| Rubber: | | | | |
| Products | 148,015,391 | 197,394,638 | 300,393,796 | 1,138,216,019 |
| Capital | 98,979,636 | 162,144,564 | 267,671,422 | 960,070,726 |
| Ratio | 0.67 | 0.82 | 0.89 | 0.84 |
| Leather tanning: | | | | |
| Products | 252,620,986 | 327,874,187 | 367,201,705 | 928,591,701 |
| Capital | 242,584,254 | 332,726,952 | 332,180,085 | 671,341,553 |
| Ratio | 0.96 | 1.01 | 0.90 | 0.72 |
| Cement: | | | | |
| Products | 29,873,122 | 63,205,455 | 101,756,444 | 175,264,910 |
| Capital | ......... | 187,397,608 | 243,485,046 | 271,269,259 |
| Ratio | ......... | 2.97 | 2.40 | 1.55 |
| Clay products: | | | | |
| Products | 135,352,854 | 168,895,365 | 172,864,051 | 283,342,106 |
| Capital | 230,882,977 | 316,022,470 | 324,564,093 | 422,606,325 |
| Ratio | 1.71 | 1.88 | 1.88 | 1.49 |
| Glass: | | | | |
| Products | 79,607,998 | 92,095,203 | 123,085,019 | 261,884,080 |
| Capital | 89,389,151 | 129,288,384 | 153,925,876 | 215,680,436 |
| Ratio | 1.12 | 1.40 | 1.25 | 0.82 |
| *All Mfg. Industries:* | | | | |
| Products | 14,793,902,563 | 20,672,051,870 | 24,246,434,724 | 62,418,078,773 |
| Capital | 12,675,580,874 | 18,428,269,706 | 22,790,979,937 | 44,466,593,771 |
| Ratio | 0.86 | 0.89 | 0.94 | 0.71 |

For 1919, the industry covering sulphuric, nitric, and mixed acids, had the highest ratio—$1.63—followed closely by the cement industry with $1.55. The glucose industry showed the lowest ratio with only $0.26, the next was starch, with $0.45.

Whereas most branches show a reduction in capital ratio in 1919 over previous years, the general chemical industry has shown a steady increase from $1.28 in 1904 to $1.49 in 1919.

Perhaps the most significant comparison is that between the ratios for the various chemical industries and the averages for all manufacturing industries. It will be noted that the industries most generally referred to as "strictly chemical" in nature, such as chemicals, sulphuric, nitric and mixed acids, fertilizers, explosives, salt, and wood chemicals, have capital ratios well above $1.00. On the other hand the average for all manufacturing industries was $0.71 in 1919. This comparatively high capital investment in the chemical industries, which from an economic viewpoint is one of their distinguishing characteristics, is due largely to the fact that these industries produce the raw materials for other manufactures rather than finished products, as judged by the ultimate consumer. Naturally the value per unit of product is lower than the average and the industry must make its profits from large-scale and continuous operation.

## Caution Urged in Using Compressed Gas Cylinders

The Interstate Commerce Commission has prescribed certain regulations for the manufacture and testing of cylinders used in transporting gases compressed to pressures over 25 lb. per sq.in. The regulations prescribe certain cylinder test requirements which must be complied with before the cylinders are acceptable in interstate or intrastate commerce by freight or express. Tests are considered necessary in order to reduce to a minimum the hazard of having in circulation cylinders which are not in proper condition to withstand the service for which they are intended.

The gases which are commonly shipped in these cylinders, and the intervals at which the cylinders must be tested are as follows:

| Name of Gas | Intervals at which Cylinders Should Be Tested |
|---|---|
| Acetylene | Once-before putting in service |
| Anhydrous ammonia | Every 10 years |
| Carbon dioxide | Every 5 years |
| Chlorine | Every 5 years |
| Ethylene | Every 5 years |
| Helium | Every 5 years |
| Hydrogen | Every 5 years |
| Hydrocarbon gases (other than acetylene) | Every 5 years |
| Methyl chloride | Every 5 years |
| Nitrous oxide | Every 5 years |
| Oxygen | Every 5 years |
| Sulphur dioxide | Every 5 years |
| Non-liquefied gases with pressures not over 300 lb. | Once |

When cylinders have been tested the date, that is the month and year in which the test was made, must be stamped into the metal of the cylinder near the top, i.e., a cylinder tested in March, 1925, would bear the markings "3-25."

# Types of Electric Heating Appliances For Industrial Use

## A Discussion of the Various Designs of Heaters and Their Application with Some Remarks on Heating Control and Purchase of Equipment

By Robert M. Keeney
General Engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

THE application of electric heating to industrial processes by use of metallic resistors may follow several different lines:

(1). Localized heating up to a temperature of 800 to 1,000 deg. F., as is required on moulding presses, shoe machinery, or wrapping machines.
(2). Air heating up to 750 deg. F. as in rooms or ovens.
(3). Solution heating.
(4). Melting of white metal or compounds, the melting point of which does not exceed 1,000 deg. F.
(5). Heating of furnaces up to 1,800 deg. F. for the heat treatment of steel or the firing of vitreous enamel.

A variety of standard heaters or heating elements has been developed for such purposes, and in cases where the application is broad, complete apparatus has been built such as glue pots, babbitt melting pots and bread baking ovens. Some of these standard heaters are the space heater or clamp-on heater, the steel clad heater or plate heater, the cartridge heater, the oven heater and the immersion heater. All of these heaters have either ribbon or wire as heating elements. The ribbon may be slotted or wound, and mounted in a mica sheath or mounted open upon insulators. The wire is generally coiled and insulated with magnesia or alundum, or mounted open in refractory insulation.

One form of space heater consists of a flat nickel-chromium ribbon wound on mica and wrapped in mica, with the element thus insulated, assembled under pressure in a steel case, at each end of which there are terminals to which the ends of the ribbon are connected. The terminals may be flat eyelets in the steel case, insulated from the case, or right angle terminals carrying eyelets insulated from the case. The latter method is advantageous in that electrical connections can be made more readily when the heater is clamped against a flat surface such as a tank. The space heater is usually made 1½ in. wide by $\frac{5}{16}$ in. thick with a length of from 12 in. to 72 in. The most commonly used length is the 24 in. heater having 500 watts capacity for operation on either 110 or 220 volt circuit.

There are two general applications for the space heater: air heating and heating tanks or plates to which the heater is clamped. Air heating applications are very numerous particularly in the heating of isolated buildings or rooms such as watchmen's houses, scale houses, pump houses, and crane cabs. In the chemical industry, economy results in heating isolated rooms and eliminating long steam lines which are expensive to maintain and operate. Many space heaters are used in low temperatures baking and drying ovens. In this manner they are applicable to the rubber industry for heating curing ovens. The paper industry dries pulp samples in ovens heated by space heaters.

Next to air heating, the greatest application of space heaters has been in the heating of tanks containing water, pitch, oil or chemicals. In the mining industry, space heaters heat powder thawers, and keep compressed air lines from freezing. Another use is to obtain quick flowing of fats and oils which congeal in pipes after a nightly shut down. Battery manufacturers melt battery compound in tanks heated by space heaters. The shoe industry dries shoes. In all industries there has been a wide application of space heaters for heating water in wash rooms and for preventing the freezing of water lines and valves.

The steel clad heater differs from the space heater in three main features: the terminals are on one end only; there may be two separate heating elements in the heater; and the heating element is a slotted ribbon. The steel clad heater may be of the wide type, 2¼ in. wide by $\frac{5}{16}$ in. thick, or of the narrow type, 1⅛ in. wide by ⅜ in thick. The length is variable up to 12 ft., as the heater has been built in many sizes for special applications. The narrow type heater consists of a slotted nickel-chromium ribbon heating element with two legs, insulated by mica and encased in a flattened sheet steel

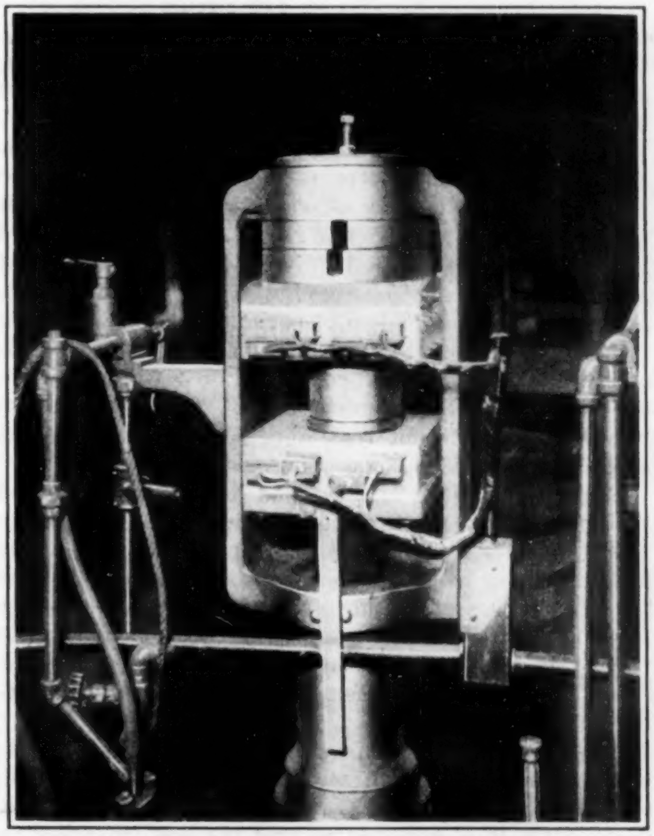


Fig. 1—Steel Clad Electric Heating Units
This view shows the application of these heaters to a Bakelite molding press

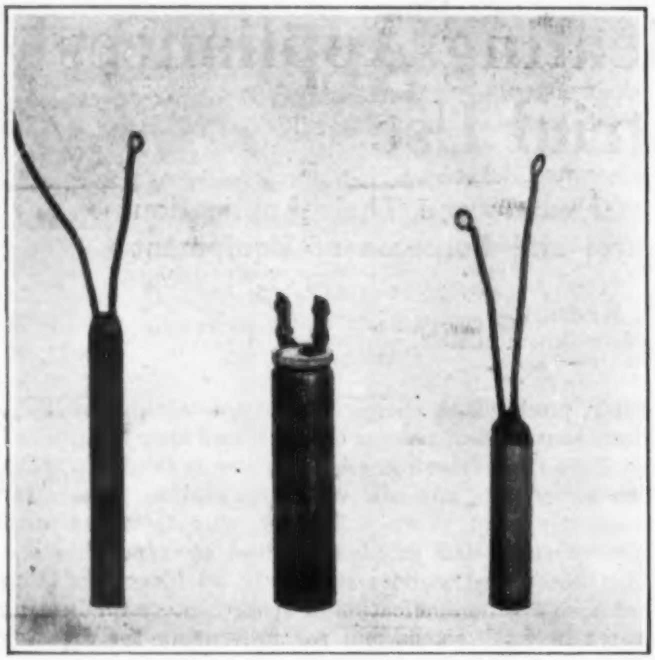


**Fig. 2—Typical Cartridge Heaters**
Heaters of this type were originally developed for use in shoe machines; but their application has since been extended

tube, at one end of which both ends of the heating element are connected to terminals enclosed in a steel terminal cover. The wide type of steel clad heater differs from the narrow type in having two separate heating elements with their four ends connected to four terminals at one end of the heater. The casing of the wide type heater and the assembly of the heater are similar to that of the space heaters. Having two elements the wide type heater with 110 volt elements can be used on either 110 volt or 220 volt circuit, the elements being in parallel on 110 circuit and in series on 220 volt circuit. This is of particular advantage to the machinery manufacturer, who must ship machines, such as wrapping machines, for operation on either 110 or 220 volt circuit.

The heating element consists of a flat ribbon, the cross section of which is varied to give the desired heating effect by cutting alternating slots across all but a fraction of the width of the ribbon. This is performed in a machine cutter set to give the proper number of slots per foot. At the center of the element no slots are cut for an inch or two to permit bending the ribbon for the return leg to the terminal end. To the ends of the ribbon are welded copper-nickel terminals which are attached to the terminal posts. The two elements may be of a different resistance so that there is considerable flexibility of power input.

Some applications of steel clad heaters are on bread wrapping machines, Bakelite molding presses, foundry pattern plates, paper box machines and shoe filler heaters. They are suitable for an application in which the temperature of the heater need not exceed 750 deg. F. on the surface of the heater. The limiting feature is failure of insulation. Good heater mica dehydrates at about 1,100 deg. F. but seems to lose some of its insulating effect at 800 deg. F.

All modern bakeries, even those of moderate size, wrap bread in a bread wrapping machine. Heat is required on the machine to soften the paraffine coated paper after it is wrapped around the loaf, in order to make it stick. Bread wrapping machines may be either steam heated or electrically heated. In the smaller bakery, the electrically heated machine is particularly advantageous because it aids in avoiding the use of all steam except for heating the buildings. The heaters are applied directly to a pan over which the bread passes.

The molding of Bakelite has become a large industry with many small units in all parts of the country. Bakelite molding may be performed in a steam heated hydraulic press or in an electrically heated press. As a temperature of about 350 deg. F. is required, high pressure steam must be used, which means a licensed fireman, and results in a high cost of steam. In such a case, electric heat has the advantage, particularly in large industrial centers with central station power obtainable at a moderate price. The maintenance of the electrically heated press is lower due to the high cost of repeated hose replacement on the steam press. In the large plant, where the molding process is simply one small department steam heat is, of course, the cheaper but electric heat still has its advantages of temperature control and ease of delivery to the press.

The cartridge heater is second only to the space heater in number of individual heaters in service, but its use is confined mainly to the shoe industry, in which it heats wax pots, machine heads and shoe filler machines. The cartridge heater as its name implies resembles a cartridge. One type consists of a nickel-chromium ribbon heating element wound on a hollow porcelain spool, surrounded by alundum powder, and encased in a brass tube, resembling a cartridge shell, with the open end closed by a terminal plug holding two brass or monel metal terminals to which the ends of the heating element are connected. The terminals may be short and rigid, or consist of flexible wire.

The cartridge type heater is used for heating machinery, which requires concentrated heat at temperatures up to about 400 deg. F. It is especially adapted to machine heads, and small parts requiring a small quantity of heat. In the shoe industry a large percentage of factories use electrically heated machines, entirely. With the introduction of motor drive in the shoe industry electric heating became the prevailing form of heating, as it eliminated boiler operation during the summer which was necessary to provide a comparatively small quantity of steam for the shoe machines. No other type of heater is as adaptable for this work as the cartridge heater because other types require too much space for these applications.

### The Oven Heater

The present type of industrial electric oven heater was designed to meet the requirements of the automobile industry for a heater to operate continuously at a maximum oven temperature of 550 deg. F. In small ovens, these heaters may be used for temperatures as high as 700 deg. F., but above this temperature there is a tendency for the heater to warp out of shape to such an extent that the element short circuits or grounds and burns out.

One common type of oven heater consists of a steel supporting frame with flanged steel ends, fastened together by 2½ in. rods, with the latter in the same vertical plane 6 in. center to center, and each of which carry a series of individual cylindrical fire clay spool insulators over which the nickel-chromium ribbon resistor is wound. Each terminal rod has one end of the ribbon clamped to it by a heavy steel clamp. Both ends of each terminal rod are threaded so that connections can be made from either end. There are holes

in the flanged end plates for hanging the heaters, fastening them together, supporting bus bar insulators and supporting a protecting screen. The construction is light and simple but strong.

In the design of the heater, the length of the loops has been limited to a point where there is no danger of loops slipping over bushings on expansion and causing a short circuit. The width of the flanged end pieces is sufficient to provide ample clearance between the ribbon and the oven wall or protecting screen. The end piece is 6 in. wide by 10 in. long. This feature is of great importance in the modern sheet steel insulated oven, as if such provision is not made in the design of the heater, considerable additional expense must be incurred in the installation of the heaters in the oven for providing a framework on which the heater may be mounted

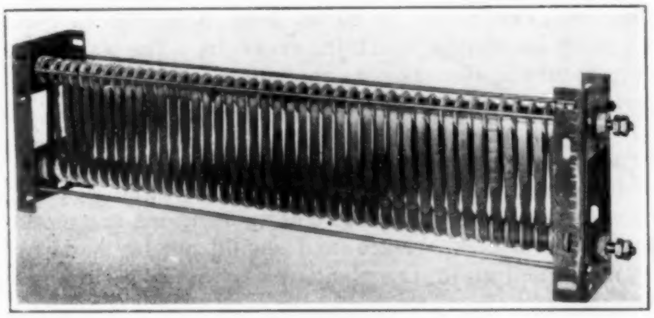


**Fig. 3—The Oven Heater**
This type of heating unit is made for use in ovens such as those used for drying materials and is good up to 550 deg. F. in continuous service

to provide ample clearance. With the length of the loop fixed, the length, width, or thickness of the ribbon and the length of the heater are varied to give the desired kilowatt capacity at a standard voltage.

In the chemical industry, electric heat is largely used by the manufacturer of artificial abrasives for baking grinding wheels. In chemical plants, oven heaters dry chemicals and heat oil with the heater immersed in the oil in the latter case. One chemical company heats air to carry on a chemical reaction with oven heaters. Some rubber plants heat curing ovens with them. The wide use of the flotation process has resulted in a large number of daily samples with high moisture content at the mill and smelter. One large corporation has found the electric oven to be the most satisfactory method of drying samples because of the ease of temperature control. The electric oven is used for the same purpose in the wood pulp industry.

Water, oil and solutions which will not attack the heater or deposit lime or alkali upon it may be heated by immersion heaters. There are three types of immersion heaters: the bayonet heater, the tubular heater and the cartridge heater. The bayonet heater consists of a flat, slotted nickel chromium resistor insulated in a mica sheath and encased under pressure in a flattened copper tube. The heater may have two or four tubes, the open ends of which are brazed into a brass head, threaded to screw into a standard pipe fitting. The tubular heater has a nickel chromium wire element in the form of a helical coil which is insulated from the tubular casing of copper or monel metal by alundum or magnesia powder. The tube is brazed to a threaded brass head as in the bayonet heater. The immersion type cartridge heater is similar to the cartridge heater already described, except that it has a water tight casing and may be screwed into a standard pipe fitting.

In the application of immersion heaters to the heating of water, oil or other solutions it must be understood that the heater should always be immersed in the liquid or it may burn out, and that some types of immersion heaters can not operate at a steam pressure exceeding 15 lb. without danger of burnout, whereas other types will stand as high as 90 lb. pressure. The immersion heater should never be used to heat solutions or water from which calcium compounds or alkali may precipitate and form an incrustation on the heater. Under these circumstances, the heat is not dissipated from the heater as fast as it generates and the heater may eventually fail. For such application or those in which through some accident the solution might not cover the heater, the space heater clamped to the tank is the preferable type of heater.

### The Medium Temperature Heater

Between the upper temperature of the average oven operation, 600 deg. F., and the lower temperature of steel hardening, 1,450 deg. F., there are several industrial operations to which electric heat can be advantageously applied, but which require a more substantial and compact heater than the oven heater and a less expensive unit than that needed for the high temperature heat treatment furnace.

The medium temperature heater fills this requirement and may be applied for a chamber temperature of 1,300 deg. F. A nickel-chromium helical wire coil, of the same grade alloy as is used for high temperature coils, is mounted in the grooves of a series of refractory blocks, which are encased in a frame of nickel with terminals at one end. The heater may be of the flexible type or the rigid type. The former is very adaptable for heating circular vessels such as babbitt pots or other melting pots. The heaters are 26 in. long, 9 in. wide, and 1¾ in. thick, and are rated at 5 kw. for temperatures up to 900 deg. F., and at 2.5 to 5 kw. for temperatures of from 900 to 1,300 deg. F.

The main applications of this heater are in tempering

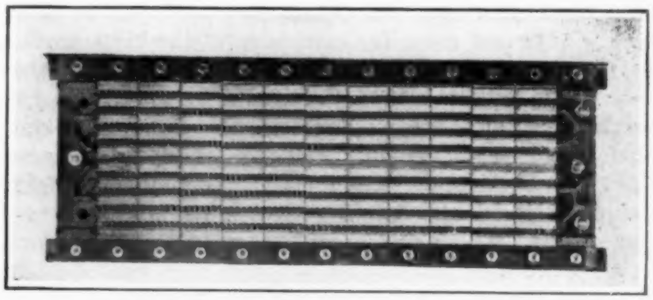


**Fig. 4—The Medium Temperature Heater**
Heating units of this type are used for service between the maximum temperature obtainable in an oven and the lower temperature of steel hardening—1450 deg. F.

ovens, heating liquids and in melting pots. It is superior to some other types of oven heaters for tempering work, because the oven heater will not stand operation at the upper limit of temperatures, on account of oxidation and sagging of the steel frame.

There are three general types of nickel-chromium furnace coils in use for chamber temperatures up to 1,850 deg. F.: the strong, heavy wire resistor supported rigidly in the furnace wall by refractory brick, with proper allowance for expansion; the self-contained heating unit easily applicable to existing furnaces; and the ribbon resistor hanging loosely over refractory or nickel chromium supports imbedded in the furnace wall. It is

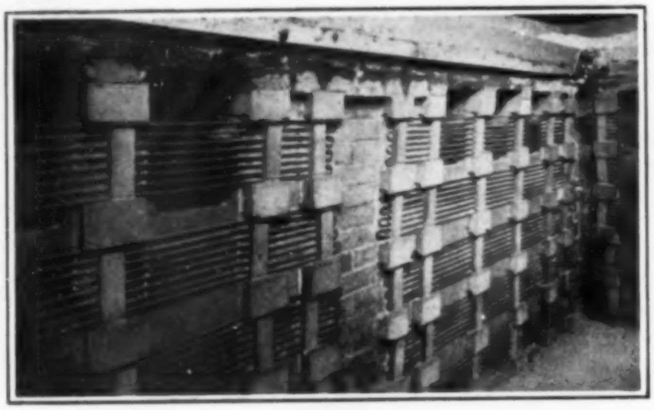


**Fig. 5—"S" Type Heating Coils**
In this view the coils are installed in a pit furnace. The T-bricks and cleats of refractory material used in holding the coils are plainly shown here

not proposed to enter into a discussion of wire versus ribbon resistor, as the life of the resistor which has been correctly proportioned for the temperature at which it is to operate does not depend upon its shape but upon the method of support in the furnace. In this respect, heavy wire has the advantage, in that it can be mounted more firmly in place with the direction of expansion always under control, which has not always been the case in some furnaces equipped with ribbon resistors. Most industrial furnace resistors are made of a nickel-chromium alloy containing approximately 80 per cent nickel and 20 per cent chromium.

The industrial furnace coil is formed from nickel-chromium wire of No. 1 to No. 4 B. & S. gage into an eight strand S shaped coil varying in length from 31½ in. to 72 in. for standard coils. Coils may be installed for floor, side walls or roof of a furnace. The manner of support is shown in the illustrations. In the construction of the inner fire brick lining of the furnace T-brick are set in the furnace wall so as to support the cleats which hold the coil at intervals of 10 to 12 in. The T-bricks project out from the wall a sufficient distance to allow a loose fit of the cleat and coil so that there is sufficient room for expansion of the brick work, but the coil can expand in only one direction, lengthwise. Side movement of the cleats is prevented by metallic lockpins set in holes in the T-brick. The T-brick and cleats are both made of highly refractory material. Coils may be mounted in double or single banking. For double banking, two cleats are used instead of one. The S coil T-brick and cleat construction is very simple to install and requires only two special refractory shapes, the T-brick and the cleat. The effect obtained in that of an exposed coil with no muffling, as the portion of the coil covered by the cleat is very small. It lends itself as readily to installation in the roof and floor as in the side walls. When used in the floor, the T-brick become part of the support of the alloy floor plate.

By use of oxide connectors, all of the coils in any series group may be connected within the furnace, thus reducing the number of terminals and giving unit coils more easy to install than a single coil all in one piece. The oxide connector consists of a tube of nickel-chromium alloy, into which is pressed a sleeve of cold rolled steel. The inside diameter of the sleeve is slightly larger than that of the wires to be connected. Set screws clamp the wires firmly in place. When the connector is heated in the furnace, the cold rolled steel oxidizes rapidly. The sleeve expands and makes a tight and practically indestructible joint, the only disadvantage of which is that to break it a hack saw must be used. For carrying a group of coils connected in series through the furnace walls nickel-chromium terminals of larger diameter than the wire are used. The terminal may be connected to the coil by an oxide connector, or a weld may be made; but the former is preferable as it will give little trouble, whereas welds have been known to fail.

A self-contained high temperature heater is useful for electrifying existing furnaces or for the concentration of heat in new installations. This heater consists of nickel-chromium wire containing 80 per cent nickel and 20 cent chromium wound in the shape of flattened spiral and assembled in cast shapes of a heat resisting alloy which hold the coil in place in refractory insulators. The heater is 26 in. long, 3 in. thick, with two sizes in widths of 11 in. or 16 in. The range of temperature is the same as that of the S bend coil but the kilowatt capacity per unit of area is much higher.

In the chemical industry, furnace coils heat large tube furnaces in which chemical reactions are being performed in gas, in oil, or in solutions while passing through the tubes. Furnace coil applications are based largely on past experience, and should not be made by the individual or by the plant unless this experience is available.

The popularity of industrial electric heating depends to a considerable extent on the ease of temperature control. Therefore, in the purchase of an electric furnace or an electric oven no attempt should be made to save money on control equipment. Cheap control equipment may not function at a critical time with the result that a batch of work may be spoiled or the heating elements burned out. Hand control through switches gives better results than cheap automatic control equipment.

Automatic temperature control should be installed on most electric ovens or furnaces. The rheostat or the transformer with voltage taps may be used to advantage on small furnaces of up to 10 kw., and small ovens may be controlled with a three heat switch. On the larger installations automatic control will pay for itself within a reasonable time.

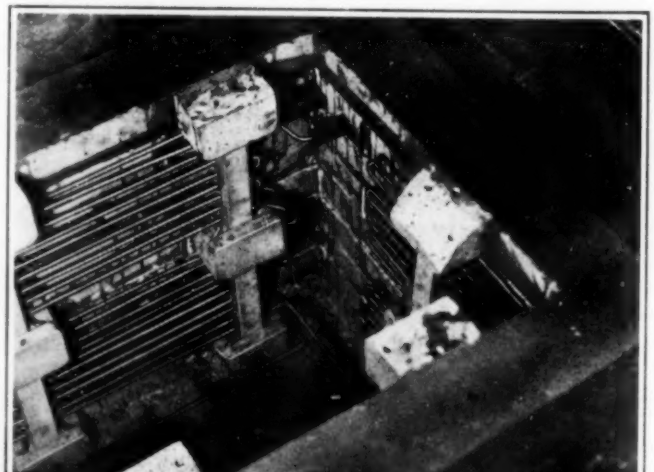


**Fig. 6—Another Method of Installing "S" Coils**
In some furnaces it is necessary to increase the number of heating units and this can be done by double banking as shown here

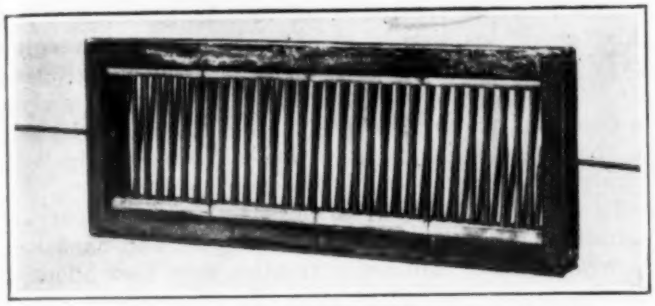


**Fig. 7—Self-contained High Temperature Heater**
This type of unit heater is useful in electrifying existing furnaces or for producing concentrations of heat

Automatic control for ovens up to a temperature of about 1,000 deg. F. usually consists of a thermostat, a magnetic contactor panel on which necessary relays and fuses are mounted, a disconnecting switch and a push button station. This system of control is the "on and off" method, i.e., all of the heaters are either on or off. Sometimes a portion of the heaters are grouped in a constant heat circuit which is controlled by hand through a magnetic contactor panel and push button station.

Automatic control of electric furnaces of the metallic resistor type is by means of the same arrangements as that used on ovens with either an indicating or a recording control pyrometer substituted for the thermostat. In addition to this, furnace transformers with taps and a tap changing switch are used on applications requiring a variable kilowatt load on the furnace such as a process having a slow heating up period or a long soaking period. A gold fuse set in the furnace or a cut out relay are often connected in the furnace control circuit so as to open the power circuit to the coils in case a thermocouple should fail and the power circuit not be opened when it should be opened.

## Considerations In The Purchase of Equipment

Electric heating equipment is designed to operate at a specified voltage and before an installation is made the actual line voltage should be determined. Operation of heating devices on voltages more than 5 per cent higher than that for which they are designed shortens their life considerably because the kilowatt output of the heater increases as the square of the voltage. In the case of high temperature furnaces, this is of particular importance, especially if the furnace is to operate 24 hours per day.

One must ascertain the alloy of which the resistor is made. For low temperature applications up to 800 deg. F., the nickel-chromium alloy containing about 65 per cent nickel, 12 per cent chromium, and 21 per cent iron is the most satisfactory. Avoid heaters using nickel steel or similar cheaper alloys as they do not have a satisfactory length of life. For high temperature work up to 1,850 deg. F. consider only the alloy containing 80 per cent nickel and 20 per cent chromium with a small amount of iron as an impurity. This alloy has proven very successful and substitutes should be chosen with caution.

Space heaters with mica insulation are not generally guaranteed for temperatures above 750 deg. F. on the heater itself. They should not be used in ovens for an oven temperature exceeding 300 deg. F. If they are used to heat a tank or container, the longest length of life will be obtained if the heater is clamped against the tank or container. If the temperature of the process will result in a higher temperature than 750 deg. F. on the heater itself and a heater of the shape of a space heater is required, use the space heater with refractory insulating material instead of mica. This heater will operate satisfactorily up to a temperature of 1,000 deg. F., but it can not be bent. The space heater with mica insulation can be bent into a semi-circle.

The same care should be used in selection of immersion heaters. The mica insulated heater is satisfactory for water tanks up to 15 lb. pressure, but can not be installed to heat oil at 450 to 500 deg. F. For such temperature or for steam pressure of up to 90 lb. the immersion heater with refractory insulation should be selected.

In the application of oven heaters to a new oven or an existing oven, consideration should be given to the thickness of insulation, distribution of heaters in the oven, ventilation system and the type or heater with particular reference to expense of installation. The oven and its doors should be insulated with at least 2 in. of insulating material for temperatures up to 300 deg. F. and above that temperature 4 in. is preferable. In the case of panel ovens attention should be given to the quantity of steel in the structure making through connection between the inner and outer wall, as iron has a heat conducting capacity approximately one thousand times that of high grade insulation. On existing brick ovens it is generally necessary to line the oven with insulating material and rebuild the doors.

To secure proper heat distribution throughout the oven the heaters must be properly located with reference to the ventilation and for obtaining the most uniform results mechanical ventilation is advisable on large ovens.

As the buyer usually installs the oven heaters, a heater should be selected, which does not require an extensive superstructure inside of the oven for the support of the heaters and bus-bars, and which provides sufficient clearance between the wall and the heater ribbon. A type of heater which can be hung against the oven wall and which provides clearance by its end frames and on which the bus bar can be supported is preferable.

Electric heat treating furnaces are a comparatively new development, although the total capacity now installed in the country is about 25,000 kw. In the purchase of such equipment primary consideration should be given to the financial responsibility and reputation of the selling company for standing behind its apparatus. At the present time, aside from standard box type furnaces, practically every furnace is custom made for the job.

For industrial plant production, a furnace of rugged heavy construction should be chosen with a minimum of 7 in. or more of insulation depending on the application and an inner lining of fire brick. A laboratory furnace type of construction generally is not satisfactory for production work.

In selection of the type of resistor, recall that whether it is a ribbon or rod, is of minor importance, the essential point being the method of support and location of the resistor in the furnace. Practically all processes can be performed more rapidly if there is bottom heat in the furnace. The resistor should be strongly supported in place so that expansion is under control at all times. A resistor of thin cross section whether rod or ribbon should be avoided.

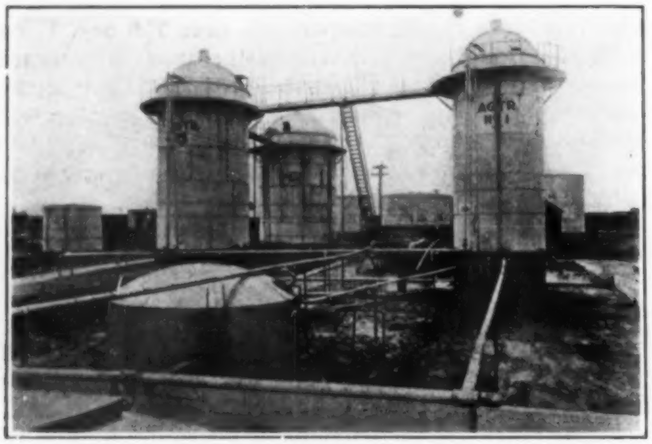


Fig. 1—Group of Conventional Tank Agitators of the Hemispherical Roof Type for Batch Treatment of Distillates

# Agitation and Mixing in Petroleum Refining

### Batch Treatment of Distillates by Air Stirring Being Replaced by Continuous Units of Closed Type

By Myron J. Burkhard

Engineer, The White Eagle Oil & Refining Company

AS AN important step in the refining of various petroleum fractions, it has been found necessary to treat them with portions of strong sulphuric acid, mix the oil and acid intimately, and draw off the resulting sludge, after which the oil is washed with water and neutralized with a caustic solution. For a detailed description of the amount and type of reagents, degree of treatment, and other details, the reader is referred to Morrell (*Chem. & Met.*, 1924, vol. 30, p. 785-87). An extract, showing typical treatment for naphtha, is sufficient for our purposes here:

"Method 2-A (a) Agitate with sulphuric acid (15 to 20 min. for 1,000 bbl. batch). Settle and draw off sludge.

"(b) Short water wash, usually 5 to 10 min.

"(c) Agitate with plumbite solution until sweet to 'doctor test'—(20 to 30 min. for 1,000 bbl. batch).

* * * * * *

"(d) Wash for a short period with water, agitating if suspension is removed, but simply showering if suspension is still present to avoid emulsion.

"(e) Distill in the presence of steam following the precaution shown in Method 1, preferably using a continuous method."

This is typical of the sequence of operations, though different oils require variations of the treatment to suit their own peculiar requirements. Apparently the first devices for this operation were horizontal barrels, fitted with paddle stirrers which, like the barrels, were made of wood.

During the early days of the industry, when the burning-distillate, or kerosene fractions, were the ruling product, the operation was carried out in an "agitator." This is a vertical, cylindrical tank, with a conical bottom, and is usually lined with sheet lead. In the center, a pipe extends well down into the cone to introduce the air blast. The treatment of kerosene and lubricating oil distillates is still carried out in apparatus of this type, and it may be seen that the specifications of the foregoing treatment for naphtha indicate the use of such apparatus.

With the increasing demand for gasoline, it has become evident that the older method of treatment was unsuited to the treatment of volatile fractions. The chief objections were: (1) The loss due to sweeping away of valuable vapors with the stream of agitating air; (2) it was a batch method, and was carried out in costly apparatus; and (3) the increased fire risk due to the deliberate saturation of the refinery air with highly inflammable vapors.

To meet the need of a closed circuit, without air agitation, for the treatment of gasoline and naphthas, various forms of continuous treaters have been adopted. The basic form of all is after the diagram in Fig. 3 adapted, with modifications, from Bell's "Handbook of Petroleum Refining." In this system of continuous treating, the reagents are maintained in the towers, and the oil to be treated is pumped through them in a continuous stream, gaining its treatment while in passage. In order to secure the degree of contact or time of settling needful to the operation, Bell recommends the following velocities:

(a) Velocity through the acid and soda tanks for distillates of poor quality should not exceed 1 ft. per min. and the treat period should be 36 min. For good distillates this rate may be doubled.

(b) Velocity in settlers should not exceed 1 ft. per min.

It is evident that proper compliance with these requirements for a plant handling a large quantity of oil would require large towers, or a large number of a smaller type. At times, there has also been difficulty due to the oil passing through the reagent in large globules, only the outside of which has received treatment. Realizing that the required intimacy of mixture could be obtained more cheaply and more certainly by other means, the refiners turned to the orifice mixer.

A form of the orifice mixer, or "knothole mixer," was described by Young and Peake (*Chem. & Met.*, 1922, vol. 27, pp. 972-76). The mixer they indicate is a plate, with a star-shaped opening, placed between the flanges of a coupling. The area of the star-shaped opening approached two-thirds of the area of the pipe, and the oil and acid (in their case, oil and bleaching solution), are forced through a number of orifices before entering the treating towers. This allows the use of smaller treating towers.

In the extended development of this method, the treating towers have tended to be replaced by a length

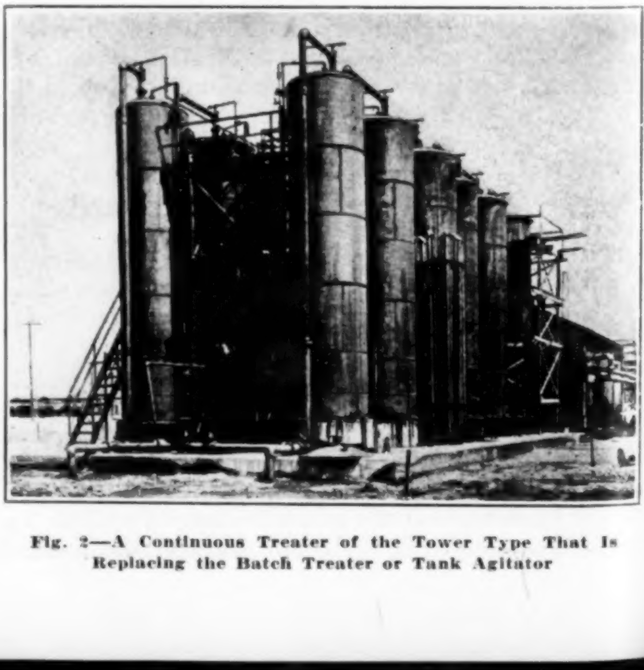


Fig. 2—A Continuous Treater of the Tower Type That Is Replacing the Batch Treater or Tank Agitator

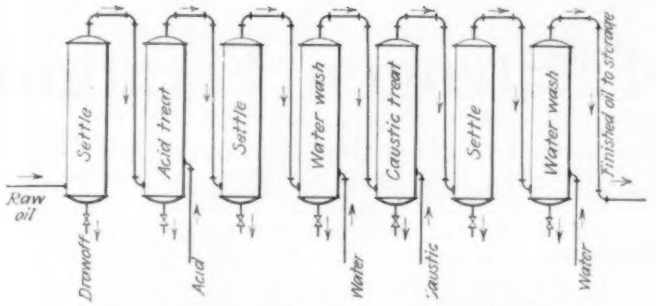



**Fig. 3—Continuous Treater for Light Distillates**
Each tower is supplied with proper relief valves, pressure gages and level indicators.

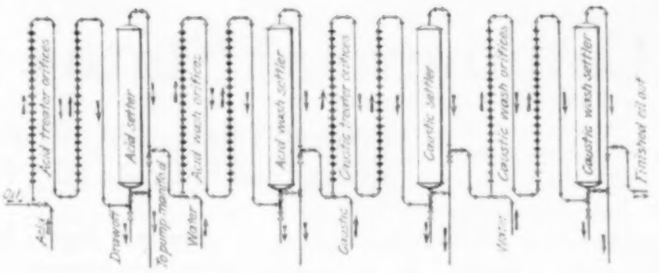



**Fig. 5—A Recent Development in Mixing**
In this design, the treating towers have been replaced entirely by orifice tubes, and only the settling towers remain.

of pipe containing orifice flanges, though the settling towers remain. A phase of this development is shown in Fig. 4. The control of this plant is secured by carefully governing the pumping pressures in the oil lines, and by calibrating orifices in the reagent lines. This installation is also modified to permit the addition of a "doctor wash" in the last unit. The system permits of great flexibility in the addition or cutting out of units, and time and degree of treatment may be modified to suit the requirements of any particular stock.

Probably the greatest point of difference in individual installations has been in the type of orifice used. As the treating plants are usually built within the refinery, every refiner has exercised his individual judgment as to the shape of orifice used, and the relation between the orifice area and the cross-sectional area of the pipe in which it is placed. The type making use of a plate between flanges is the more usual, because of the ease with which it may be constructed in any size pipe desired. Likewise, each refiner has placed the tube containing the orifices in a horizontal or vertical position, as seemed best to him. The net result is that given an efficient type of orifice, it does not matter a great deal whether the tube containing it is placed vertically or horizontally. In some cases, though, it has been found that there is a slight increase in efficiency when the tube is changed from a horizontal position to a vertical one, possibly enough to save the junking of equipment which was inadequate when placed horizontally. In any case, the vertical installation is probably more economical of ground-space and supporting structure. It is significant that a 5 ft. by 36 ft. settling tank at a Wyoming refinery failed when laid upon its side, and functioned in a satisfactory manner when placed on end.

Types and relative sizes of orifices have been many and varied, as has been stated, but the general trend seems to be toward a simple orifice, in the shape of a circle, or segment of a circle, the area of which is approximately one-third of that of the cross-section of

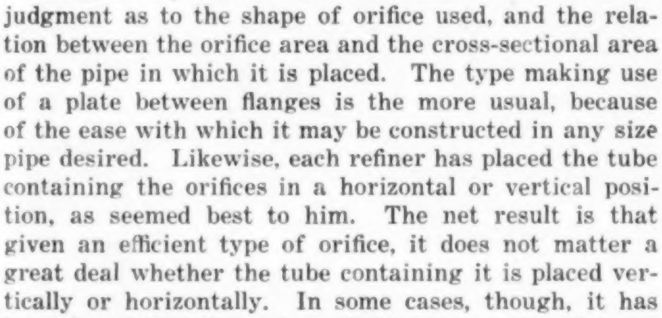



**Fig. 4—Modification of Continuous Treater**
In this system, a length of pipe containing orifice flanges has largely replaced the treating towers, though the settling towers remain.

the pipe in which it is to be placed. Some refiners have placed all orifices in the center of the plate, and others have offset them, and placed them in alternating positions. From purely theoretical considerations, the offset location seems better, as there would be a possibility of straight-line passage for some of the fluid in the center-hole type. In regard to spacing, it is the practice to place the plates distant from one another a space about 4 or 5 times the diameter of the pipe.

For control of the amount of oil passed into the system, a closely regulated pump seems sufficient, and for the acid, a needle valve working between a constant pressure in the oil line and a constant pressure in the acid supply tank is suitable. In large installations, when careful control of costly reagent is wanted, an orifice meter would be suitable.

A recent design is shown diagrammatically in Fig. 5. It may be seen that in this design, the treating towers have been entirely replaced by orifice tubes, and only the settling towers remain. This results in a much more economical construction for treating a given capacity, as the item of greatest cost is towers. The treating or mixing unit consists of two vertical runs, each containing 20 orifices. The tube is of 4-in. pipe, and the orifice is 2 in. in diameter, in a plate ¼ in. thick. The orifices are offset, placed in alternating positions in the tube. The distance between each pair of orifice plates is 12 in. Each settler is equipped with proper gage glasses, relief valves, blow-off cocks, and draw-off cocks. The piping is so arranged that any unit of the plant may be bypassed by use of the pump-out manifold, which, in ordinary running, is empty. Also, by use of this same manifold, in case of leaky settlers, recourse may be had to the ordinary batch agitators of the plant for use as settlers. Only the acid-settling tank and the acid-wash settling tank need be lead-lined.

## Hydrocyanic Acid Hazards

Mark Walker and D. N. Eldred of the Pacific R. & H. Chemical Corporation have studied the hazards in the handling of liquid HCN, and the prevention of accident by adequate provisions based on definite knowledge. Various explosions of containers have occurred, and an exhaustive research was carried out, using bombs filled with the acid, which were subjected to controlled temperatures and pressures, whereby all actual storage conditions likely to prevail were duplicated in a reasonable period of time. The cause of the explosions (certain objectional compounds) was determined and a study was made of the product of the reaction—a black mass resembling charcoal and associated with sundry gases.

# Commercial Status of Nitrogen Fixation

## Present Trend of Synthetic Industry Indicates that Further Reductions in Costs May Result from Improved Technology

By J. M. Braham
Atmospheric Nitrogen Corporation, Syracuse, N. Y.
Former Chief, Chemical Division, Fixed Nitrogen Research Laboratory

THE IDEA OF tapping the inexhaustible supply of nitrogen in the atmosphere to meet a need fundamental in both war and peace has appealed strongly to both the scientist and industrialist. Consideration has been given to this problem for over a century, but it is only in the last 25 to 30 years that the real progress has been made. An exceedingly large amount of investigational work has been done on the fixation of atmospheric nitrogen, and hundreds of processes have been proposed and a large number tried out, but only three have produced nitrogen compounds cheaply enough for fertilizer use. These are commonly referred to as the arc, the cyanamide, and the synthetic ammonia processes. There are at present no new, promising fixation methods, but the possibilities have by no means been exhausted.

The nitrogen fixation industry began 20 years ago in Norway, when the arc process was first successfully operated on a commercial scale. This electrochemical process is by far the simplest of the three processes, consisting essentially in passing air through an electric arc, thereby forming nitric oxide, cooling the furnace gases to ordinary temperature and absorbing the nitrogen oxides in water to form dilute nitric acid. This process, however, requires an exceedingly large amount of electrical energy, and it is only in Norway where power at very low cost has been available, that the process has been successful on a very large scale. At present more that 95 per cent of the world's output by this process is produced there. The growth of nitrogen fixation using this method is seen in Fig. 1. It will be noted that it now produces only 6.4 per cent of the total atmospheric nitrogen fixed. There has been practically no increase in the arc fixation capacity since 1916, and as far as is known there are no new projects of consequence under way. No outstanding improvements have been made in the process since it was successfully put into operation in 1905, and unless the energy requirement can be materially reduced, there is very little future for the process, except under special circumstances.

The fixation of nitrogen by absorption in finely divided calcium carbide at a high temperature was developed almost simultaneously with the arc process, the first commercial plant starting in 1906. Owing to the fact that it consumes less than one-fourth the electric energy required for the arc process, or about 15,000 kw.-hr. per metric ton, cyanamide plants were much less restricted as to location than arc plants, and by 1913 cyanamide was being produced in nine different countries with a combined output of 34,000 tons of nitrogen. Cyanamide can be readily converted to ammonia and thence to nitric acid, and consequently there was a great demand for this material during the World War. At the end of 1918 there were in operation and under construction 36 plants with a rated capacity of 325,000 metric tons of nitrogen. The actual production for that year, however, was about 210,000 tons of nitrogen. The nitrogen demand fell off sharply at the end of the war and a number of plants, particularly those partially completed, were scrapped. Many others have remained in stand-by condition as is the case with the huge plant at Muscle Shoals. The present annual production of nitrogen by the cyanamide process is estimated to be 135,000 metric tons. This is considerably less than half the present installed capacity. The capacity of certain plants favorably located as to power, raw materials and market has been increased during the last three years, but taken as a whole the condition of the cyanamide industry has been rather unsatisfactory.

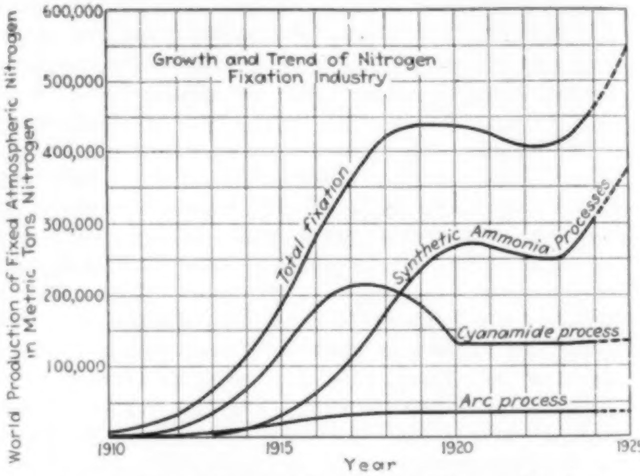



**Fig. 1—Fifteen Years of Progress in Nitrogen Fixation**
The significant growth of the synthetic ammonia processes, and the decline of cyanamide have been the determining factors in the trend of the curve for total fixation. The arc process, it will be noted, has just about held its own.

There have been no improvements leading to a decided reduction in fixation costs by the cyanamide process for many years, but the quality of the product has been greatly improved. The main item of cost is the manufacture of calcium carbide and opportunities for lower costs in that process appear very limited. As seen from Fig. 1, the cyanamide process now produces approximately one-quarter of the total nitrogen fixed.

The direct combination of nitrogen with hydrogen under conditions of relatively high temperature (450-600 deg. C.) and very high pressures (1,500 to 15,000 lb. per sq.in.) in the presence of a catalyst is the most recently developed, and by far the most important fixation method. This method originated in Germany with the investigation by Haber and his co-workers, and was put into commercial operation there in 1913. The

Paper presented at the Forty-eighth General Meeting of the American Electrochemical Society, Chattanooga, Tenn., Sept. 24, 25 and 26, 1925.

energy required is approximately only 4,000 kw.-hr. per metric ton of nitrogen fixed, and this fact has been largely responsible for the tremendous development of the synthetic ammonia industry in Germany, where water power is very limited.

The synthetic ammonia process was not operated successfully outside of Germany during the World War, but investigations were begun at that time in a number of countries, and as a consequence several modes of operation were independently developed which are now generally referred to as different processes. Thus we have the Haber process in Germany, the Casale process in Italy, the Claude process in France, and still others which have been developed in England and in this country. They are all fundamentally the same and differ mainly in the conditions under which ammonia is formed and in the method of hydrogen production.

The Haber or Haber-Bosch process consists in producing the hydrogen-nitrogen gas mixture from water-gas and producer-gas, highly purifying the mixture, compressing it to about 200 atmospheres and subjecting

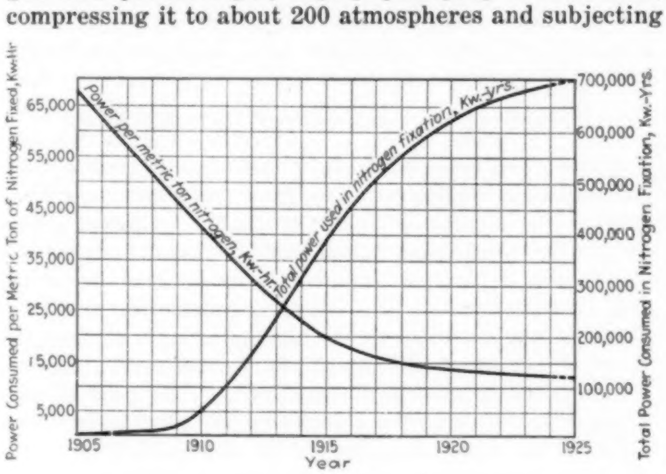



**Fig. 2—Relation of Power to Nitrogen Fixation**

The sharp fall of the curve at the left should help to disallusion those who believe that power is still the vital factor in nitrogen fixation.

it to the action of a catalyst at about 550 deg. C. Only a small percentage of the hydrogen and nitrogen combine in a single pass through the catalyst and hence the unconverted gas is recirculated after the removal of the synthesized ammonia by scrubbing with water.

The Casale process is quite similar to the Haber process, but ordinarily electrolytic hydrogen is employed and the operating pressure is from 600 to 750 atmospheres. The conversion to ammonia in a single pass through the catalyst is considerably higher than in the Haber process, and hence the ammonia is readily obtained from the synthesis system as a liquid.

The Claude process operates at 900-1,000 atmospheres and instead of using but one catalyst chamber in the synthesis system, the nitrogen-hydrogen mixture is passed through a series of catalyst chambers, resulting in the conversion of the greater part of the gas mixture. The direct product is liquid ammonia. The production of hydrogen from coke-oven gas by liquefaction methods has been developed by Claude in France for operation with this method of ammonia synthesis.

In this country we have a synthetic ammonia plant operating at about 100 atmospheres pressure and using water-gas hydrogen and another at 300 atmospheres employing electrolytic hydrogen.

The principal item of cost in the synthetic ammonia process is the production of hydrogen in a sufficiently pure form. Indeed, it has been stated, and correctly so, by M. Georges Claude, in France, that the nitrogen problem has in reality become a hydrogen problem. Three methods are now commercially employed for the production of hydrogen for ammonia synthesis: (1) The water-gas catalytic process in which water-gas is first produced and then subjected to the action of steam in the presence of a catalyst, thereby converting the carbon monoxide of the water-gas to carbon dioxide and hydrogen; (2) the separation of hydrogen from coke-oven gas by liquefaction methods; and (3) the electrolysis of water. The first is by far the most important at present, furnishing the hydrogen for perhaps 95 per cent of the synthetic ammonia produced. The coke-oven gas liquefaction process has been employed only in France and as yet on a relatively small commercial scale; the production of electrolytic hydrogen is a new electrochemical development from the standpoint of nitrogen fixation, and has greatly stimulated the development of large and efficient electrolytic hydrogen-oxygen cells. About 3 per cent of the hydrogen used in ammonia synthesis is now supplied in this manner. The total energy requirement in case hydrogen is obtained by electrolysis is about 20,000 kw.-hr. per metric ton of nitrogen fixed. Hydrogen produced as a by-product in the alkali industry is also employed in ammonia synthesis, but the quantity available at any one place is relatively small.

### Novel Production Process

A new and very interesting method for the production of hydrogen for ammonia synthesis is now being developed in this country by the Phosphorus-Hydrogen Corporation at Niagara Falls, N. Y. The process consists briefly in producing elemental phosphorus in an electric furnace from a charge consisting of phosphate rock, sand and coke, and then treating the phosphorus with steam in the presence of a catalyst, thereby producing hydrogen and phosphoric acid. The latter will be used in the manufacture of ammonium phosphate.

It appears that all of these methods for hydrogen production will have a place in the development of the synthetic ammonia industry in this country. Those producing hydrogen from coal or coke (water-gas, coke-oven gas, etc.) will no doubt be the most important. Although electric power in this country is too expensive in general to be used for hydrogen production, it is believed that electrolytic hydrogen will, nevertheless, be a factor in ammonia production, since ammonia plants can be operated at new water-power projects during the period required for the development of a more profitable power market.

The development of efficient catalysts not only for ammonia synthesis but for use in hydrogen production and purification is also an important phase of the synthetic ammonia problem. Notable progress has been made in this field in the last two or three years, and even greater progress can be expected in the next few years. The chances for materially reducing the cost of fixed nitrogen compounds through further improvements in hydrogen production and purification and in the field of catalysis appear very good.

Synthetic ammonia plants are now in operation in eight different countries, with an estimated total production for this year of 380,000 metric tons of nitrogen. The quantity considerably exceeds the present output of Chilean nitrate. Two plants in Germany which now have a combined capacity of 300,000 metric

tons of nitrogen are being considerably enlarged. One of these plants has a capacity equivalent to 1,280,000 tons of Chilean nitrate, or five times the capacity of the cyanamide plant at Muscle Shoals. The relation of the various fixation processes as to production is shown in Fig. 1. It will be noted that over two-thirds of the total nitrogen fixed is by the synthetic ammonia process, and that the trend in nitrogen fixation methods is definitely in the direction of further progress with this process.

### Relation of Power to Fixation

Power no longer plays the important rôle in nitrogen fixation which it formerly did. In the light of the more recent technical advances in nitrogen fixation, it becomes necessary to modify the opinion, so commonly held, that very cheap power is a prime requisite. Cheap power is, of course, an advantage. Fig. 2 shows not only the striking decrease in the amount of energy required per ton of nitrogen fixed from 1905 to the present time, but also shows the enormous increase in total energy consumed in the nitrogen industry. It will be noted that the energy required per ton of nitrogen today is less than one-sixth that when the industry first started and that the trend is still definitely downward. The estimated power consumption for this industry at present is 704,000 kw. or 944,000 hp.

The relation between power consumed and nitrogen fixed is further illustrated in Table I.

The striking fact shown by these data is that whereas the arc process produces only 6.4 per cent of the total output of fixed nitrogen with 38.6 per cent of the total power, the synthetic ammonia process, obtaining hydrogen from coal or coke, produces 66.4 per cent of the total nitrogen with only 23.8 per cent of the total power.

The nitrogen fertilizer products now being made available through electrochemical and chemical fixation

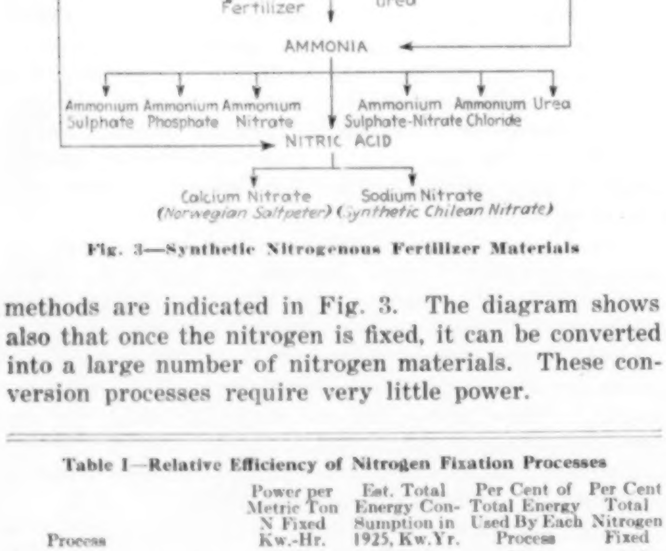



Fig. 3—Synthetic Nitrogenous Fertilizer Materials

methods are indicated in Fig. 3. The diagram shows also that once the nitrogen is fixed, it can be converted into a large number of nitrogen materials. These conversion processes require very little power.

**Table I—Relative Efficiency of Nitrogen Fixation Processes**

| Process | Power per Metric Ton N Fixed Kw.-Hr. | Est. Total Energy Consumption in 1925, Kw.Yr. | Per Cent of Total Energy Used By Each Process | Per Cent Total Nitrogen Fixed |
|---|---|---|---|---|
| Arc | 68,000 | 272,000 | 38.6 | 6.4 |
| Cyanamide | 15,000 | 231,000 | 32.8 | 24.5 |
| Synthetic Ammonia Hydrogen from | | | | |
| 1. Coal or coke | 4,030 | 167,000 | 23.8 | 66.4 |
| 2. Electrolysis of water | 20,000 | 34,000 | 4.8 | 2.7 |
| Total | | 704,000 | 100.0 | 100.0 |

The nitrogen content of these various materials is shown in Table II. Air-nitrogen compounds contain on the average a much higher percentage of nitrogen than those formerly available and hence we may expect nitrogen fixation to be an important factor in increasing the concentration of fertilizers used in this country.

**Table II—Nitrogen Content of Fertilizer Materials**

| Product, Per Cent | Nitrogen Content* |
|---|---|
| Cyanamide | 22.0 |
| Urea | 46.6 |
| Ammonium Sulphate | 21.2 |
| Ammonium Phosphate | 12.2 (61.7% $P_2O_5$) |
| Ammonium Nitrate | 35.0 |
| Ammonium Chloride | 26.2 |
| Ammonium Sulphate-Nitrate | 28.2 |
| Sodium Nitrate | 16.4 |
| Calcium Nitrate | 13.0 |

*Nitrogen content for pure materials except cyanamide and calcium nitrate. Commercial materials would be somewhat lower in nitrogen.

An outstanding fact, not usually appreciated, is that much more combined nitrogen is being obtained from the air than from Chilean nitrate or by-product ammonia. The estimated production percentages are 44, 30 and 26 respectively.

### Nitrogen Fixation in the United States

Synthetic ammonia is now being produced by the Atmospheric Nitrogen Corporation at Syracuse, New York; the Niagara Ammonia Co. at Niagara Falls, N. Y., the Mathieson Alkali Co. at Niagara Falls; and the Pacific Nitrogen Corporation at Seattle, Washington. The estimated present daily production for all of these plants is 30 short tons of ammonia, or 22.5 metric tons of combined nitrogen. It is expected that this capacity will be nearly doubled by the first part of 1926 by additions to present plants and the placing in operation of the plant of Lazote (Du Pont) at Charleston, W. Va.

These plants are at present supplying the liquid anhydrous and aqua ammonia market and as far as is known not a single ton of fixed nitrogen produced within the United States is being used as fertilizer. There is an indirect effect, however, in that the synthetic ammonia is driving more of the by-product ammonia into the fertilizer market. Although the anhydrous ammonia market is expanding, the anticipated production in 1926 will somewhat more than meet the requirements and hence further increase in production capacity will have to find an outlet as fertilizer.

The American Nitrogen Products Company is operating a small arc process plant near La Grande, Washington. The product is sodium nitrite. (See *Chem. & Met.*, October, 1925, pp. 803-4.)

Nitrogen is being fixed on a comparatively small commercial scale in the form of sodium cyanide by the California Cyanide Company, Inc., at Cudahy, California. The products are sodium cyanide and hydrocyanic acid. Although cyanide nitrogen can be readily converted to ammonia, the cost of fixation by the cyanide process is too high to compete with either the cyanamide or the synthetic ammonia processes in the production of ammonia.

There is no production of calcium cyanamide in this country. The Government-owned cyanamide plant at Muscle Shoals has remained in stand-by condition since its test run the first part of 1919. The decision as to the future disposition of this plant is now before Congress.

# Söderberg Electrode Shows Low Operating Cost

### Total of 71 Furnaces Now Operated and Projected by 41 Companies in Carbide and Metallurgical Industries

**By M. Sem**
Metallurgical Engineer, Det Norske Aktieselskab for Electrokemisk Industri, Oslo

THE first larged-sized selfbaking Söderberg electrode, a 34-in. electrode in a 2,000-kw. ferrosilicon furnace at Fiskaa Verk, Kristianssand, Norway, was installed in July, 1919 and is still running. In the 6 years of service, more than 900 ft. of the electrode were consumed in the furnace without a single breakage or other trouble.

The slipping of the electrode in the holder is always done at full current load by simply loosening some of the screws of the holder until the electrode slides down by its own weight. The running of the furnace is therefore absolutely continuous. At the present time fore than 40 concerns are employing the system under licenses from the inventors.

The Söderberg electrode has been run side by side with ordinary carbon electrodes in many plants, thereby making possible a comparison, the results of which have invariably evidenced a saving in favor of the new system. Most factories, however, object to publication of their results and consequently, it is not possible to give specific figures except from steel-furnaces where full details have in one case been published.

The actual cost of making Söderberg electrodes in this country is between 2.5 and 3.8c. per lb., the cost varying with the size of the electrode, type of furnace and local conditions. It includes depreciation and interest on the first cost of installation. Instead of making their own paste, some users find it advantageous to buy the paste from an electrode factory. In Norway, France and Germany paste for Söderberg electrodes can be purchased from certain factories at reasonable prices. The paste is transported in blocks without packing and the blocks are given a shape so as to fit to the heating boxes of the different users.

The reported savings in the electrode consumption are due partly to the absence of butts and partly to less air corrosion of the electrodes.

The electrodes are made from a paste that is much

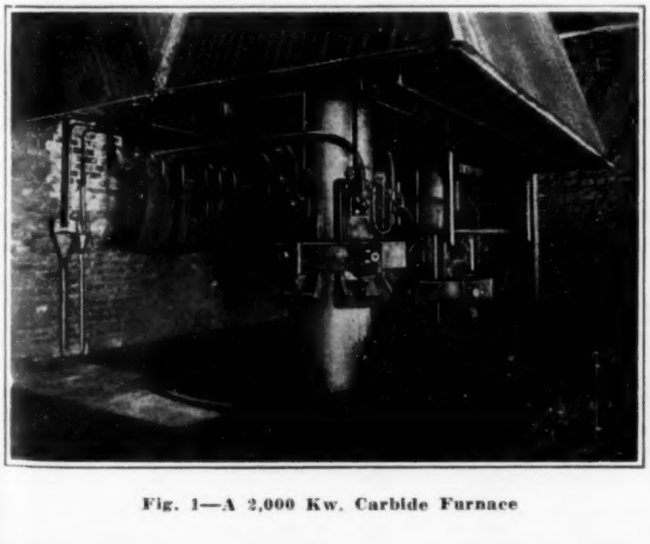


Fig. 1—A 2,000 Kw. Carbide Furnace

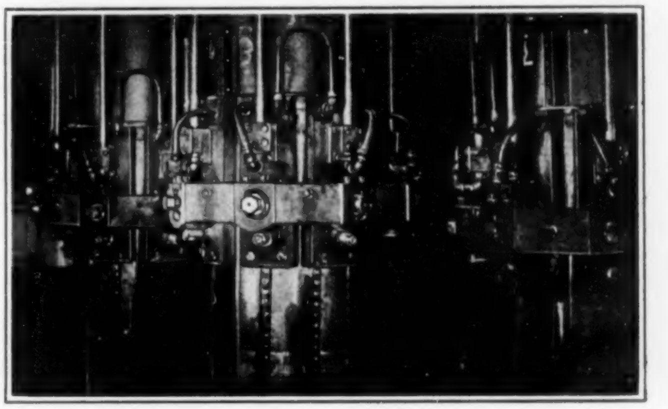


Fig. 2—Three Electrodes of 39 In. Diameter in the Furnace of the Canada Carbide Co., Shawinigan Falls, Que., Canada

**Table I—Location, Capacity and Number of Furnaces in Plants Using Söderberg Electrodes**

| Location | Number of Furnaces Installed or Projected | Number of Companies | Application | Furnace Statistics | | | |
|---|---|---|---|---|---|---|---|
| | | | | Installed, Kw. | Projected, Kw. | Total, Kw. | Capacity, Kw. |
| Norway | 10 | 6 | Fe, alloys, abrasives, Ni, steel, Al | 13,000 | ...... | 13,000 | 15,000 |
| Sweden | 7 | 3 | $CaC_2$, alloys, Fe | 28,000 | ...... | 28,000 | 50,000 |
| Germany | 19 | 11 | $CaC_2$, alloys, steel | 49,000 | 21,000 | 70,000 | 90,000 |
| Switzerland | 1 | 1 | ............ | ..... | 2,000 | 2,000 | 15,000 |
| Italy | 8 | 6 | Alloys, $CaC_2$, steel | 5,000 | 7,000 | 12,000 | 45,000 |
| France | 11 | 7 | $CaC_2$, alloys, steel | 7,000 | 7,000 | 14,000 | 100,000 |
| Great Britain and colonies, (South Africa) | 4 | 3 | $CaC_2$, steel | 3,000 | 1,500 | 4,500 | 5,500 |
| Japan | 6 | 1 | $CaC_2$, alloys | 14,000 | .... | 14,000 | 50,000 |
| U. S. A. and Canada | 5 | 4 | $CaC_2$, alloys, | 14,000 | 2,000 | 16,000 | 50,000 |
| Total | 71 | 41 | etc. | 133,000 | 40,500 | 173,000 | 420,000 |

softer than the paste for ordinary electrodes. Due to the special baking conditions of the Söderberg electrode, the density is the same as for the ordinary kind. Although a sample made from Söderberg paste and baked outside of the furnace will only show an apparent sp.gr. of about 1.4, the sp.gr. of the baked electrode is usually from 1.5 to 1.55, showing that considerable shrinking takes place. As a rule it can be said that the Söderberg electrode shows the same electrode consumption as do ordinary good carbon electrodes of the same shape and from the same kind of raw materials and which are working continuously, without butts, breakages and with practically no air corrosion.

Of great interest in connection with the new electrodes is that in many instances it is possible to improve the design of the furnace as well as the furnace practice. This leads to closed furnaces instead of open ones and also to mechanically-charged

**Table II—Electrode Consumption**

| Product | Electrode Consumption per Short Ton of Product, Lb. | Electrode Consumption per 1,000 Kw.-hr., Lb. | Savings in Consumption as Compared to Ordinary Electrodes Per Cent |
|---|---|---|---|
| $CaC_2$ | 17 to 80 | 4.5 to 20 | 15 to 70 |
| FeSi (45 to 50 per Cent Si) | 45 to 80 | 6.5 to 11 | 15 to 70 |
| FeMn (80 per cent Mn) | 80 to 90 | 6 to 11 | 15 to 70 |
| Tool steel from cold scrap | 24 to 35 | 25 to 40 | 5 to 25 |
| Electric pig-iron (Electrometall. Furnace) | 8 to 10 | 0.3 to 4.5 | 15 |

furnaces. In many plants this interesting development is actually taking place. But even more radical changes have been attempted successfully. The so-called hollow Söderberg electrodes are actually in use. Smaller hollow electrodes have been used occasionally before, but at present several hollow electrodes of a size up to a 56-in. diameter and with a 20-in. hole are in regular operation for a special purpose.

## Mills-Packard Water-Cooled Chambers Operating at Armour Works

The Armour Fertilizer Works has completed recently two sulphuric acid plants designed to use the Mills-Packard system of water-cooled chambers. Pictures of the Wilmington, N. C., plant are shown herewith. This plant, together with one at Jacksonville, Fla., comprise the only installations in the United States, although the process has been in successful operation in other parts of the world since 1913.

As can be seen from Fig. 2, the chambers are in the form of truncated cones, and are cooled by a film of water that wets the entire exterior. According to recent authorities, 143 chambers were in use in June, 1923, the total capacity being about 1,250,000 cu.ft., which of course is equivalent to much more chamber space of the ordinary type, as operation with the Mills-Packard system is successful at 3 cu.ft. of chamber space per lb. of sulphur burned. (See W. Wyld, "Manufacture of Sulphuric Acid (Chamber Process)," p. 63.)

The principal operating and erection advantages claimed for the process are (1) low niter consumption, (2) low depreciation of lead chambers, (3) low capital cost, and (4) small ground space is required.

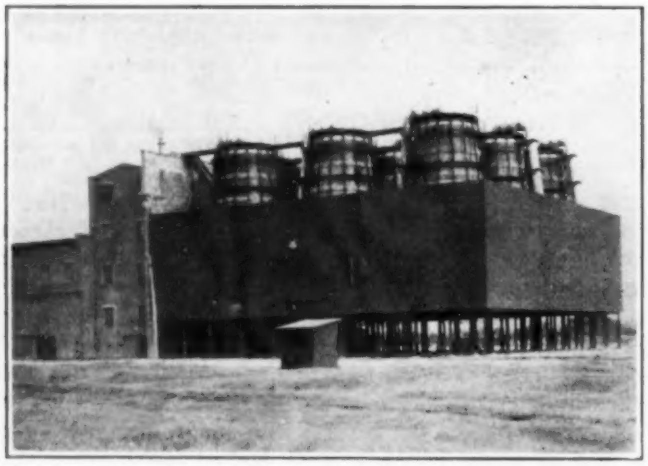


Fig. 1—General View of the Set of Acid Chambers Recently Erected at the Wilmington, N. C., Plant of Armour Fertilizer Works

Fig. 2—Detailed View of Chambers, the Design of Which Is Peculiar to the Mills-Packard System

The gases are introduced into the chamber through an inlet flue in the base, the angle of incidence being such that the flow is directed on the acid in the base pan or dish. It is necessary carefully to reinforce the flues by means of rings placed at frequent intervals. These rings can be seen plainly in Fig. 2. The ceilings, which are not visible here, are raised, and provision is made for water cooling. As is usual with this type of chamber, the framework is of steel, although frames of wood and of reinforced concrete have been used.

Operation is said to be flexible, as it is possible to compensate for accelerated reaction rate by increasing the amount of cooling water. In fact cooling by this means is so efficient that repairs on the lead work of the original set were virtually negligible after 8 years of service.

## Third Benzol Report Published

The third progress report of the sub-committee on benzol, chemical section, National Safety Council, has been published for the Council by the National Bureau of Casualty and Surety Underwriters.

Studies of the past year show that the use of benzol (except in closed systems) involves a substantial hazard even when the concentration of vapor is only 100 p.p.m. The committee recommends the use of harmless substitutes whenever possible; and it endorses frequent medical examinations.

## Refractories for Coke Ovens

In a report of Committee C-8, American Society for Testing Materials, read at the 28th Annual Meeting, Atlantic City, N. J., June 23, 1925, the following classification of refractories for by-product coke ovens was given:

| Part | Material Used | Maximum Temperature | Slagging | Load as Given for Koppers Ovens | Load Conditions in Semet-Solvay Ovens | Abrasion | Spalling | Tentative Classification |
|---|---|---|---|---|---|---|---|---|
| Foundation material | Clay | 1000°C. | No | 25–30 lb. per sq.in. | Important | No | No | M-7 |
| Main flues | Silica and clay | 540° C. (1000°F.) extraordinary 700 to 76° C. (1300 to 1400°F.) | No | 16–20 lb. per sq.in. | Important | No | No | H-7 |
| Lower bench walls | Silica | 1000° C. | No | 18–20 lb. per sq.in. | Important | No | No | H-7 |
| Korbels of checker chambers | Silica | 1000 to 1400° C. | No | 20–25 lb. per sq.in. | Important | No | No | H-7 |
| Checkers | Clay and silica | 1000 to 1500° C. | No | 8–10 lb. per sq.in. | No | No | No | H-1 |
| Curtain walls inside | Silica | 1000 to 1400° C. | No | .............. | No | No | No | H-1 |
| Curtain walls outside | Clay | 200 to 1000° C. | No | .............. | No | No | No | L-1 |
| Upper division walls | Silica | 1000 to 1400° C. | No | 12–15 lb. per sq.in. | Important | No | No | H-7 |
| Flue blocks | Silica | 1200 to 1500° C. | No | .............. | Important | Important | No | H-9 |
| Oven chamber floor | Clay | 1000 to 1200° C. | No | 3– 6 lb. per sq.in. | No | Important | No | M-3 |
| Oven roof | Silica | 1000 to 1200° C. | No | 6–10 lb. per sq.in. | Important | No | No | H-7 |
| Oven roof ends | Clay | 1000 to 1200° C. | No | 5–10 lb. per sq.in. | Important | No | No | M-7 |
| Charging holes | Clay | 800 to 1200° C. | No | .............. | No | Slight | No | M-1 |
| Jamb blocks | Silica and clay | 1000 to 1500° C. | No | 15–20 lb. per sq.in. | No | Important | Important | H-75 |
| Top material | Clay | 600 to 1000° C. | No | 5–10 lb. per sq.in. | No | No | No | L-1 |

# Ceramics at the Bureau of Standards

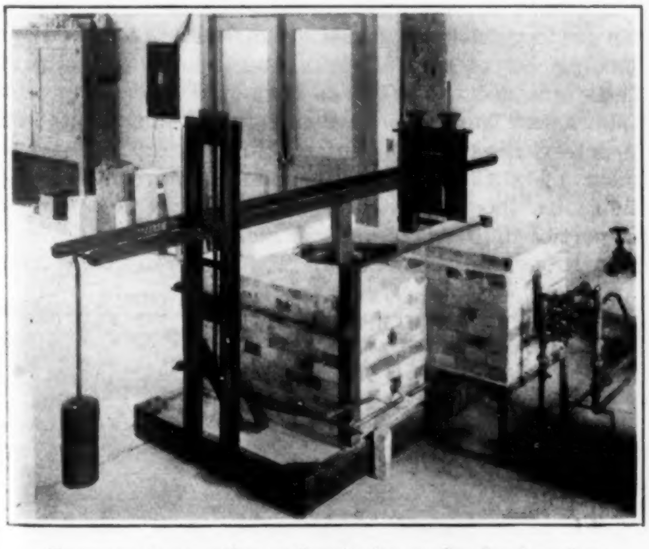
## Research and Development in the Production of Refractory Materials for the Cement and Glass Industries Receiving Much Attention

IT IS difficult to realize the dependence of all industries upon refractories. The metallurgical industry is not only dependent upon refractories, but in certain phases it is actually limited in development by the limitations of the refractories. Our power plants are also limited, not by the temperature that they may develop from their fuel, but by the refractory that they use in their fireboxes. Even the ceramic industry itself is dependent and in some cases limited in its production by the refractories used in building the kilns, muffles, saggers, glass pots, glass tanks, etc. As a consequence, this field of ceramics is one of the most interesting and most vital. Its extent prevents the Bureau from engaging in but a limited number of its problems.

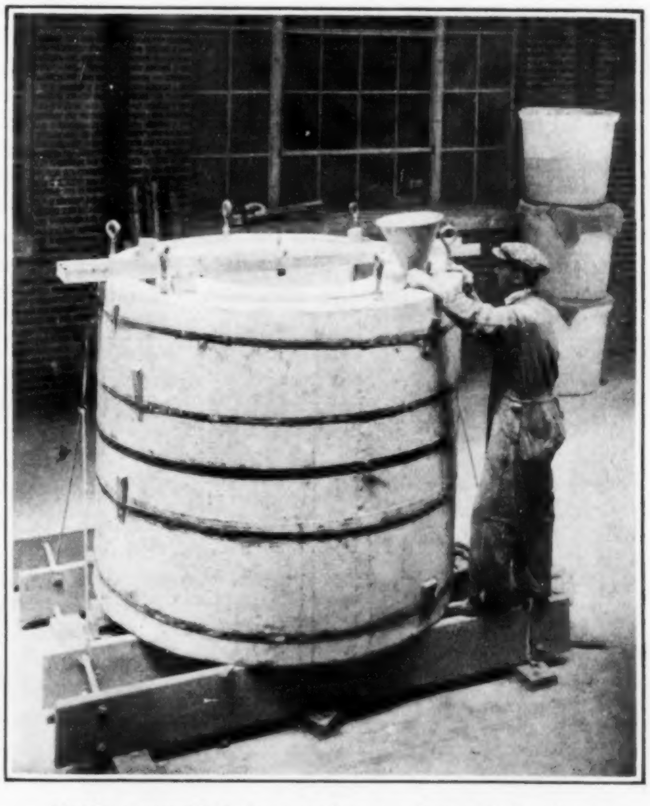
*Brick for Rotary Cement Kilns*—The great demand for refractories capable of meeting the increasing severity of furnace conditions, and the high cost of the so-called special refractories, has compelled the industry to focus its attention on the production of the very best product that can be made with the raw materials at hand. For certain types of service this has resulted in a rapidly increasing use of clays containing 50 per cent or more alumina and a minimum of fluxing material. To study one phase of this problem, 8 brands of high-alumina refractories and 2 brands of high-grade fireclay refractories, which are used by the trade under conditions of service requiring resistance to the corrosive action of lime and cement clinker at high temperatures, were subjected to several laboratory tests, including the softening point determination, the constant volume test, resistance to sudden temperature change by quenching from 850 deg. C. to running water, the determination of absorption before and after the constant volume test, deformation under load at high temperatures, and the resistance to slagging by cement clinker.

The results obtained indicate that for refractories containing 50 per cent or more alumina: (a) the softening point will equal or exceed that of Orton standard pyrometric cone No. 34; (b) the material will withstand 18 or more quenchings without failure; (c) the absorption determination would not indicate a satisfactory product; (d) when specimens are subjected to a load of 25 lb. per sq.in. at a maximum temperature of 1,450 deg. C., the deformation will not exceed 5 per cent. The softening point of a mixture of equal parts of refractory and cement clinker is equal to or exceeds that of Orton standard pyrometric cone No. 6. This test would, of course, apply only to material intended for service requiring resistance to the slagging action of cement clinker.

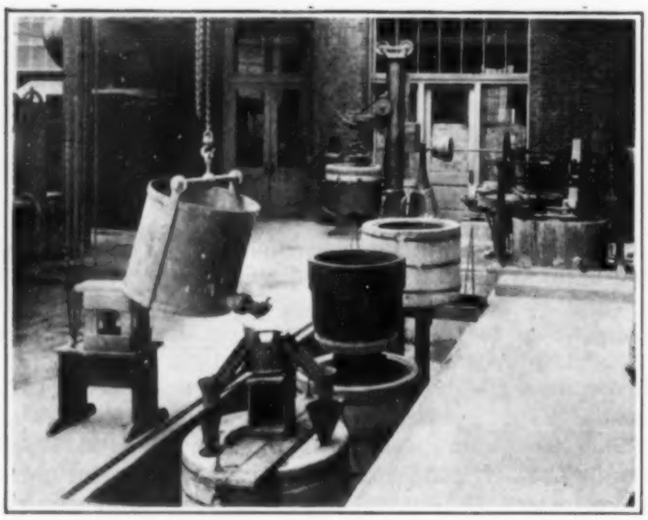
*Brick for Stoker-Fired Settings*—This investigation, which was undertaken following a conference of government representatives, users, and producers of fireclay refractories, has for its primary motive the establishment of specifications for use by the government departments in the purchase of these materials. The investigation was limited as nearly as possible to the highest known grade of fireclay refractories, having in mind the application of the results to the use of this material in stoker-fired boiler settings. Refractories of 42 brands representative of the product as manufactured in the United States were obtained for laboratory testing through the co-operation of Stone & Webster. A thorough field survey was also made.



*Furnace for testing refractories under load and at high temperatures*



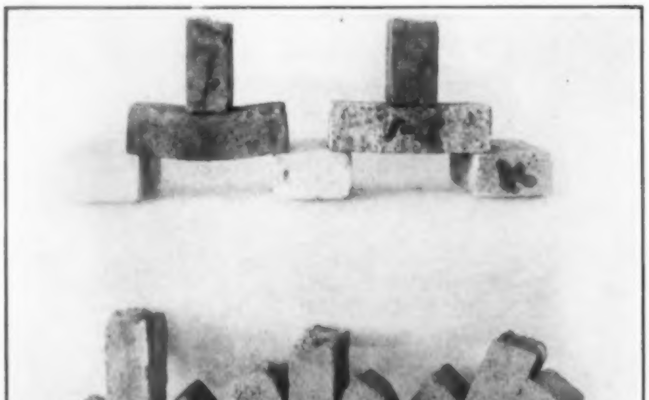
*Molds assembled for casting a glass pot having a capacity of 5,000 lb. of glass*



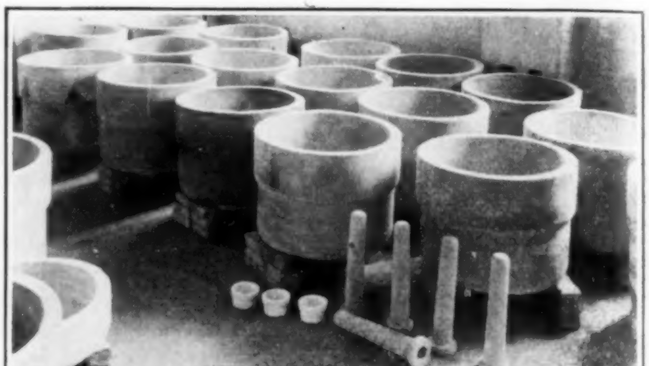
*Stages in the process of making glass pots by the casting process. At the extreme right is the blunger for mixing clays; at extreme left a mold is assembled and the clay slip is about to be poured*

In the laboratory the refractories were subjected: (a) to an endurance test (in which bricks were held at 1,450 deg. C. for 72 hours, both with and without load); (b) to a constant volume test (in which the change in volume and porosity was determined after the brick had been held at 1,400 deg. C. for 5 hours); (c) to a quenching test; (d) to the standard A.S.T.M. load test, and to modifications of this test; (e) the softening points were determined by the cone method; and (f) bricks of each brand were analyzed chemically, and several were examined petrographically.

As a result of the laboratory work, it was found that a close relation existed between data obtained in the endurance, constant volume, quenching, and softening point tests, and that these depended to a remarkable extent on the chemical composition. The results indicated that a refractory which would successfully withstand 15 quenchings from 850 deg. C. to running water also had a softening point equivalent to at least that of cone 32; that the per cent linear change in the endurance test would not exceed 2 per cent and the deflection in the same test, when transversely loaded, would not exceed 0.3 of an inch; that the per cent absorption after the constant volume test would lie between 6 and 10 per cent; and that the refractory should contain



*Typical examples of firebrick after subjection to an endurance test while loaded transversely*



*A series of porcelain glass pots awaiting use; each holds about 1,000 lb. of molten glass*

not more than 4 per cent flux and 20 per cent uncombined quartz. The results also favor the dry-press process for manufacturing brick.

*Resistance of Tank Block to Glass Attack*—Probably one of the most annoying sources of trouble for the manufacturer of commercial glass on a large scale is the lining of the glass melting tanks which frequently fail through corrosion after 10 to 14 months service, resulting in considerable loss of time and money. As the need for better tank refractories is so generally felt, it was determined to conduct an investigation on the various typical brands now used, together with linings of special composition prepared in the laboratory, in order to determine the relation between: (a) refractory composition, (b) conditions of service, and (c) life. Although the investigation as first outlined included the making of a large number of small tanks which would be filled with glass batch of commercial composition and subjected to heat in a larger furnace, conferences with manufacturers have resulted in the discarding of this scheme and the replacement of it with the construction of a tank of essentially the same design as used in the industry, but on a miniature scale. The walls of the tank are constructed of experimental linings, the glass batch introduced at one end and the molten glass drawn off at the opposite end so as to approximate the flow of glass through a commercial tank. The melting is now in progress, but too few tanks have failed, to permit of drawing any conclusions.

*Problems Relating to Saggers*—It is necessary to protect pottery from the gases and dirt in the kilns during burning by placing it in containers called saggers. These are used as often as they will serve to protect the ware. Their life is therefore an important item in determining the cost of making pottery. The first phase of an investigation looking toward increasing their life has consisted of determining the physical properties of 51 clays used in making saggers for pottery throughout the country. The properties considered

*Blocks from one side of a 1x1x4 ft. glass tank operated at the Bureau in the study of glass-tank blocks*

were porosity, volume shrinkage, and transverse strength, as produced by burning specimens to cones 3, 6, 9, 12, and 13. It has been believed that the reuse of the sagger results in a constant deterioration with each heating. Consequently specimen bars of each of 2 clays and a mixture of the 2 were made and given from 1 to 17 burns under plant conditions, and other specimen bars of each of 3 clays and a mixture of the 3 were made and given from 1 to 23 burns under plant conditions. The data have been partially studied and indicate that a mixture of these clays produces a better body than any of their components. However, in only one case did a clay show continuous deterioration after the fifth burn, indicating that failure of saggers is probably due to other causes than reheating. The work on the drying and burning behavior of sagger clays has resulted in the accumulation of a vast amount of data which, although interesting, do not permit the drawing of any conclusions until further physical and chemical properties are determined.

*Miscellaneous Refractory Problems*—A number of pieces of refractory block which had been in use in different parts of glass tanks and pot furnaces were examined petrographically in order to determine how the molten glass, batch dusts, and furnace gases acted on the refractories, and to discover the order of resistance of the different constituents of the refractories. The results of these examinations indicate that high alumina refractories should resist the solvent action of the molten glass and the fluxing action of the soda in the furnace atmosphere better than fireclay refractories.

In the study of the life of boiler settings the slagging action of the ash thrown against the setting was studied by a method which may be of some interest. A furnace was constructed in which a panel of the refractory under investigation was placed, and a flame directed against it. Into the flame was fed finely ground slag which was carried against the test panel, and adhering to it caused in time an amount of corrosion depending upon the refractoriness of the panel. Of necessity the results indicate but one of the requirements that a setting must have. But it is one of the requirements which must always be considered along with others.

The bureau produces all the glass pots which it uses in making optical glass. These are porcelain, made by the casting process. They consist of ball clay, kaolin, feldspar, flint and sized grog of burned kaolin and ball clay. The technique developed at the bureau is such that it has been a matter of about 2 years since any failure in burning or using pots has occurred, and failures in casting are less frequent than have been those in hand making.

## Flammability of Rayon Tested

Recent work at the Bureau of Standards shows that yarn and kitted fabrics made from four kinds of rayon (acetate, nitrocellulose, cuprammonium and viscose) are not especially flammable. When compared with cotton yarn, samples of rayon made by the cuprammonium process had a slightly greater flammability than cotton, viscose rayon tested about the same as cotton, and the nitrocellulose and acetone samples were found to be less flammable than cotton. Thus another popular fallacy is dispelled.

# Relation of Tar Utilization to Coal Carbonization

**Under Present Conditions the Byproducts of Low Temperature Processes Do Not Promise Sufficient Profit to Justify Their Use**

**By S. R. Church**
Consulting Engineer, New York, N. Y.

THERE is abundant evidence of public sentiment in favor of smokeless fuel, and in many quarters there is also a strong desire for relief from dependence on Pennsylvania hard coal. For example, the Canadian Government is seriously considering an act which proposes a subsidy to those who will convert Canadian coal into coke for fuel purposes.

Many, in fact most, bituminous coals can be made into smokeless or relatively non-smoking fuels by carbonization. Generally the converted product will bring a better price than the raw coal.

The questions arise—who should undertake the conversion of smoky coals into attractive non-smoky fuels, and why and how? These questions are being carefully studied by public and private bodies.

There are many well developed methods by which coal can be converted into coke; but the widespread interest in new processes is sufficient indication that the old methods, gas retorts and coke ovens, are not entirely suitable for the primary purpose of making smokeless domestic fuel.

In addition to coke, the established systems of carbonization produce gas, light oil (motor benzol), ammonia and tar. All of the tried and projected new processes for making smokeless fuel produce gas, light oil and tar; but the so-called "low temperature" methods yield little or no ammonia; and the character of the other by-products is profoundly different from that of "high temperature" retort or oven by-products.

### Carbonizing at Low Temperatures

Franz Fischer's new book on "The Conversion of Coal into Oils" is the latest and most important work dealing extensively with low temperature carbonization. Fischer writes as a scientist without commercial bias. However, his premises regarding the value of the products of "low temperature," and especially the value of the tar, seem strangely at variance with the viewpoint of those in this country who have expert knowledge of values of coal by-products.

Fischer takes the position that "low temperature" should be rather definitely limited by certain recognizable characteristics of the tar, which he specifies. He establishes 550 deg. C. as the maximum point for "low temperature." He terms tars which satisfy his specification "Primary Tars."

Before taking up the question of tars, which is our principal concern, the other products of true "low temperature carbonization" may be briefly considered. Extravagant claims for high yields of motor fuel from low temperature processes are not supported by the evidence. Fischer gives few figures but says that the "gas benzine" from these processes is chemically different from "benzene." The yield is relatively low, not exceeding 1.5 to 2½ gal. per ton of coal. From the tar little or no benzine can be expected. A report on the Parker plant at Barnsley (England) gives the yield of "crude spirit" as 1.78 gal. per ton of coal. This

cannot be considered a strictly low temperature process since "the temperature throughout the setting varies from 600 to 800 deg. C."

One low temperature process which has been operated in this country for some months produces gas from which evidently some light oil could be recovered, but up to the present time no recovery has been attempted. The tar from this process also contains a small amount of light oil boiling in the motor fuel range. The only way in which large yields of motor fuel can be obtained from low temperature carbonization is by subjecting the tar or part of it to a secondary thermal or chemical treatment, for instance, cracking, which will entirely change its properties.

Regarding ammonia, Fischer says that it is formed only above 600 deg. C., hence true low temperature processes produce none. The Parker and McLaurin processes both claim considerable yields of ammonia, equivalent to 14 lb. sulphate and 17 to 30 lb. sulphate respectively—further evidence that neither of these two principal British systems of "low temperature carbonization" is accurately described by that term.

### Fuel Yielded by Carbonization

As to the fuel, only a few broad statements need be made. All true low temperature systems excepting those involving the application of pressure to the plastic fuel in the retort, produce a friable "semi-coke" which is not directly useful as domestic or boiler fuel. The friable, more or less formless semi-cokes that many low temperature processes produce may be briquetted, and in this form will be very attractive but the cost is excessive.

A low temperature process which uses an interior screw for propulsion and compression of the coal gives a massive fuel of highly desirable quality, from certain types of bituminous coal. This process is not yet on a commercial basis. Another low temperature process in which the coal is continuously impelled through a horizontal retort produces some large pieces, together with a preponderance of coarse and fine particles of semi-coke. This will have to be briquetted to make a saleable domestic fuel.

These two last mentioned processes are the most fully developed projects in the U. S. where domestic fuel is the prime object. Both of them produce tar in large volume which, at the present time, is practically unmarketable except at fuel oil value.

### Value of Low Temperature Tars

Perhaps the best evidence of the difference between values in Europe and in the United States is the fact that Fischer devotes 30 pages (about 10 per cent) of his book, to a discussion of the possibility of converting the phenolic bodies from low temperature tar into motor-benzine. On the other hand, the advocates of certain low temperature processes in this country base their claims of high tar value largely on the presence of goodly amounts of "tar acids" in the tar.

We have a large and increasing demand for certain kinds of tar acids, notably cresylic acid of close boiling range, for making resins of the phenol-formaldehyde type. Unfortunately, both phenol and the normal cresols occur only in very minor proportion in the low temperature tars. The "tar acids" are mainly of higher boiling point and higher molecular complexity than cresols. While considerable research work is being directed to low temperature tars, and particularly to the phenolic bodies, there is today no profitable use either for the oil "per se" or for the high boiling acids, in large volume.

The oil from low temperature tar, either with or without removal of acids, does not meet the requirements of creosote for wood preservation. In common with creosote it has only the presence of phenolic bodies. The principal standard specifications for creosote as adopted by the American Railway Eng. Association and the American Wood Pres. Association do not demand or exclude tar acids. The governing requirements of these specifications are minimum limits of specific gravity, both on the original creosote, and certain fractions distilled from it. These limits effectually bar not only petroleum products (if present in important amount) but also low temperature tar products. On distilling low temperature tar to coke, the total distillate will have a specific gravity value about 0.95, while the corresponding distillate from high temperature tar will approximate 1.10. Some believe that the former has good preservative value, but it will require years to demonstrate this. Meanwhile the railroads, who consume 80 per cent of the creosote used in the United States, will choose normal creosote as long as it is available.

### Medium Temperature Carbonization

Instead of "low temperature" which leads into by-products of unknown value or "high temperature" which requires refractory linings and produces coke more suitable for the blast furnace than the house furnace, it may be possible to arrive at a happy medium.

Fischer and other writers have described the thermo-chemical formation of a primary tar. Up to a certain temperature, which Fischer says is about 550 deg. C., there is no decomposition of the coal distillate, which consists principally of higher phenols, acid-resins, paraffin and olefines. As the temperature increases, these compounds are reconstituted until at the highest carbonization temperatures of the gas retort or coke oven (1,000 to 1,200 deg. C.) mainly aromatic compounds result. For example, benzene is formed by condensation of olefines and by reduction of phenols. At this maximum temperature the yield of tar is ¼ to ½ the yield at low temperature.

There is an intermediate temperature stage in which the higher phenols are converted into lower boiling tar acids (normal phenol and cresols) and the olefines converted into aromatics, but the total tar acid content of the tar remains high; naphthalene and anthracene are present only in small amounts, and the yield of tar is almost equal to the maximum low temperature yield. This critical temperature can be attained without exceeding the limits of a metal lined retort.

Ideal conditions will result in:

1. A fuel of good size, and directly saleable for household fires.
2. Light oil and ammonia equal in value to that recovered from coke ovens.
3. Tar in greater volume than is obtained from by-product ovens, and containing a high proportion of tar acids and creosote, at least equal in unit value to products of high temperature tar.

The conditions under which this desirable combination of products can be obtained are now known and it is reasonable to expect that processes embracing these advantages may prove more logical and of better economic value than either very "low" or very "high" temperature for converting smoky into non-smoky fuels.

# Gas Manufacturing Trends

## Fuel and Methods for Future Gas Supply Are Considered at Atlantic City Convention of American Gas Association

**Editorial Staff Report**

FOUR thousand members and guests of the American Gas Association participated in the convention and exhibit at the 1925 meeting in Atlantic City, October 12-15. There was more interest than ever before in technical developments, both those discussed in the general and sectional meetings of the convention and those presented in the exhibit which filled every available square foot of space of the Steel Pier.

The proceedings of the business sessions indicated healthy growth in membership of all classes and a very prosperous business year. Technical men will be particularly interested in the increasing attention given by this Association to statistical work. Several of the speakers who presented papers indicated that the statistical backing for their arguments would not have been possible without this service from Association headquarters.

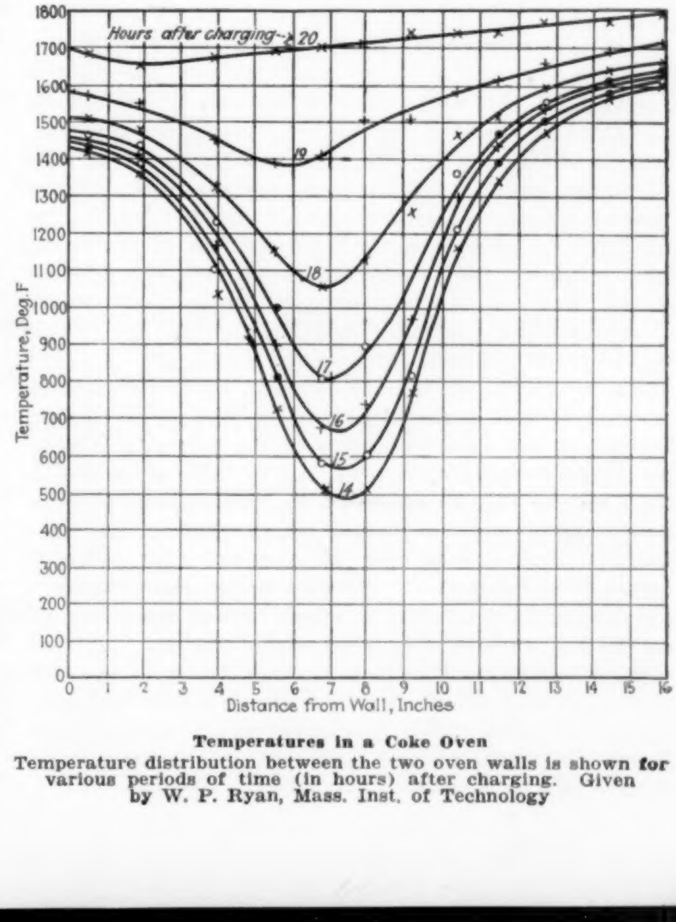
H. C. Abell, engineer of the Electric Bond & Share Company, of New York, was re-elected for 1926. A. B. Macbeth, of Los Angeles, was selected as vice-president. The corresponding officers of the technical section of the Association for the coming year will be J. P. Haftenkamp, of Rochester, N. Y., chairman, and W. C. Beckjord, of New York City, vice-chairman.

Mr. Abell in his presidential address at the opening of the convention pointed out the interest which is displayed by the Association and its membership in manufacturing and industrial utilization of gas. There is evident a wide recognition of the importance of developing gas service of suitable quality and with suitable rates for the process industries in order that manufacturing establishments may have this fuel supply available under conditions which make it more profitable than other fuels. It was pointed out that the newly established appliance laboratory of the Association is intended to insure constantly increasing efficiency in gas utilization. Every such increase in efficiency of course extends the possibilities of this fuel further in the industries.

Henry L. Doherty spoke on the raw materials of the future. He said that even the most enthusiastic interpreters of the petroleum situation have not been able to forecast any real future for that industry in further adequate increases of production. It becomes necessary, therefore, for gas companies to look to other fuels for the future, especially to the use of that material which is most economical locally for gas making. In order to promote this possibility Mr. Doherty advocates a "flexible" standard of gas quality. Under such standards each local gas company would select the heating value which it chose to maintain, being limited only by the requirement that good service must be provided to customers. He pointed out that coke oven gas has generally proven the cheapest up to the point that the coke demand takes care of the coke produced. After that point is passed it is practically necessary to provide for gasification of the coke through one scheme or another. More attention should be given in the future to low investment costs per thousand feet of gas made. Without such lowered investment cost Mr. Doherty forecasts continued difficulty in getting house heating and industrial business, which he anticipates will be the backbone of the industry in the future.

Trends in gas plant construction were analyzed by Horace C. Porter. Oil is still the major fuel source of new gas making plants, but correspondence from all parts of the country shows that this trend is probably going to change very soon and that bituminous coal will probably soon replace it. The low investment and the greater flexibility in output which is possible with water gas equipment as compared with coal gas has thus far postponed the time when the larger investments in oven and retorts will be necessary. At the present time the gas man is bidding for oil in competition with aircraft, the bus and automobile, marine users, as well as the many other oil-consuming groups.

The gas man, fearing the complications of an elaborate by-product and coke business, will doubtless continue to be a large oil user for some time; but inevitably he must turn from this raw material. The percentage of gas made by different processes during




**Temperatures in a Coke Oven**

Temperature distribution between the two oven walls is shown for various periods of time (in hours) after charging. Given by W. P. Ryan, Mass. Inst. of Technology

recent years is summarized by Mr. Porter as follows:

PERCENTAGE DISTRIBUTION FROM THE DIFFERENT PROCESSES OF GAS MANUFACTURE

| | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 |
|---|---|---|---|---|---|---|
| Carburetted Water Gas | 60.5 | 64.8 | 62.1 | 63.0 | 60.6 | 61.0 |
| Oil Gas | 8.8 | 7.3 | 8.0 | 7.1 | 6.5 | 7.1 |
| Coal Gas | 21.9 | 20.0 | 18.8 | 15.1 | 15.5 | 15.5 |
| Coke Oven Gas (purchased) | 8.8 | 7.9 | 11.1 | 14.8 | 17.4 | 16.4 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

J. A. Perry, of the United Gas Improvement Company, discussed the types of plants and the quality of gas best suited for the development of the gas industry. He pointed out the very natural fear which results from any uncertainty as to the permanence of the present types of gas-making equipment. However, there is nothing to indicate at present anything radically new in type that is sufficiently better in efficiency in any way to necessitate scrapping of present investment.

Uniformity, in heating value and in specific gravity of gas were mentioned as absolute necessities for good service, regardless of change in load. On this premise, Mr. Perry undertook to demonstrate how a base-load coal-gas plant could effectively be used with a producer-gas and a blue water-gas plant. He recommended reducing the quality of the coal gas and increasing its specific gravity by admixture of producer gas of 130 B.t.u. and 0.9 gravity to give a mixture of 440 B.t.u. and a gravity of 0.57. Then the sendout can be increased, as necessitated by the demand, by any necessary quantity of lightly carburetted water gas of the same heating value and the same specific gravity. Such water gas would require about 1.75 gallons of oil per thousand cubic feet of water gas made.

Tests on such gas mixtures have been made by Mr. Perry and it is believed they are entirely suitable for industrial as well as household use if the appliances are equipped with suitable orifices and have air shutters properly adjusted. Change from one to the other gas of this given heating value and specific gravity is entirely satisfactorily without change of orifice or air adjustment.

Such a system of gas making would put 58 per cent of the energy of the latter materials into the gas for sale and 10 per cent more of the energy would be available for sale in the only by-product made, tar. This is contrasted by Mr. Perry with the very low percentage over-all efficiency of electric public utility systems. Such a scheme would greatly reduce the quantity of oil required per thousand feet of gas made, since much of the production would be accomplished without any oil. In one example chosen the average oil consumption per thousand feet of all gas made would be 0.26 gallons.

One of the most valuable studies on carbonization reported at the convention was by William P. Ryan, Director of the Buffalo Station of the School of Chemical Engineering Practice of M.I.T., who presented a paper on the rate of travel of the fusion zone in coke ovens. Data were presented which showed the temperature distribution through the oven at different stages of carbonization. It is concluded that the thermal conductivity of coke is much higher than that of coal in the various stages of carbonization. "It also appears that either the thermal conductivity of the coal as charged does not change in order of magnitude upon fusion and conversion to semi-coke, or that any thermal change is remarkably balanced by compensating changes which offset it.

"From the above it follows that the heat of fusion and thermal decomposition is negligible in effect on the rate of heating of the coal.

"The change in rate of travel of the fusion zone has been shown and explained by the concept of the heat transfer.

"The reason for the influence of oven width on coking time and daily capacity has been illustrated by means of the rate of travel of the fusion zone."

### Ammonia Markets

The various economic factors influencing the production, sale and use of ammonia produced as a by-product of coal in the United States were discussed by Harry A. Curtis, Professor of Chemical Engineering, Yale University. It was prophesied that the continued increase in synthetic nitrogen products is inevitably going to drive all by-product ammonia from the fields of refrigeration and other markets using liquid ammonia.

Discussing this report C. J. Ramsburg pointed out the advantage to small coal-gas companies of shipping concentrated liquor to a central plant for conversion into ammonium sulphate. This conversion undoubtedly will be necessary as the shrinking market for ammonia from by-product resources reduces the outlet for ammonia liquor. Numerous coke oven plants now operating have surplus capacity for handling liquor and any of these plants should be utilized by gas companies.

Among the distribution problems of the gas industry the problem of limiting the gas demand and the use of gas indicators or demand meters is an outstanding development of industrial interest. Numerous new devices of this character had considerable emphasis placed on them in the report of the distribution committee.

Another feature of industrial interest is the importance laid by many executives present at the session upon the increasing need for industrial surveys. Partly as a result of the arguments presented by Henry Lobell, of the Combustion Utilities Corporation, it was decided that the Association should undertake a survey of industrial gas prospects. Further plans for this will be worked out through the industrial gas section of the Association.

An illustration of the advantage to industries, as well as to gas companies, of proper rate structure was given by T. V. Purcell, of Chicago, in his paper on "Rates for Industrial Gas." He gave in detail the basis upon which the rate for industrial gas service for Chicago was developed recently. This new rate schedule, which has been in force approximately three months, includes a demand charge ranging from 5 cents for the first hundred cubic feet of maximum hourly demand through 4 cents for the next 400 cubic feet, to 3 cents per cubic foot for all over 500 cubic feet of maximum hourly demand. The charge for the gas itself begins at 70 cents per thousand for the first 100 M and scales down to 45 cents per M for all over two million cubic feet. By agreement the demand is measured during the winter season so that the customer is encouraged to use more gas in the summer which is the off-peak period for the gas companies. It is anticipated that the average cost to the customer of gas sold under this rate will be about 52½ cents per M. This rate is obviously much below that usually charged for gas sold to other classes of customers.

# Recovery of Sodium Plumbite in the Oil Industry

## Newly Developed Process Saves All of Lead and Most of Caustic Soda Used in Sweetening Distillates

**By A. Kinsel**
Assistant Superintendent, Beacon Oil Company

A SIMPLE process that recovers more than 99 per cent of the lead used in the sweetening of gasoline has been in continuous operation for nearly a year at the refinery of the Beacon Oil Company, Everett, Mass. Simultaneous recovery of from 75 to 80 per cent of the caustic soda and partial use of the sludge acid are other important features of the process, which is protected by U. S. Patent No. 1,525,301 issued to A. Kinsel.

As any "treater" knows, "sour" gasoline is "sweetened" by agitation with "doctor." "Doctor" solution is prepared by dissolving lead oxide (litharge) in caustic soda solution. The product of this reaction is sodium plumbite, which combines with the undesirable sulphur component in the gasoline, precipitating lead sulphide and thus rendering the gasoline "sweet." This lead sulphide is drawn off and in the past has been discarded. The process described herewith makes possible the recovery of substantially all the lead entering the treating cycle.

The lead sulphide and spent caustic soda solution drawn from the agitators is run to a settling tank in which separation of the suspended sulphide from the caustic liquors is greatly facilitated by heating with a steam coil. The supernatant caustic solution is then drawn off to storage, and the lead sulphide is pumped to a continuous filter. Here it is dewatered as much as possible (about 30 per cent moisture is left in the cake), and is then discharged into a tank containing the necessary quantity of diluted sludge acid for converting the sulphide to sulphate. The acid used is sludge from previous gasoline treatment,

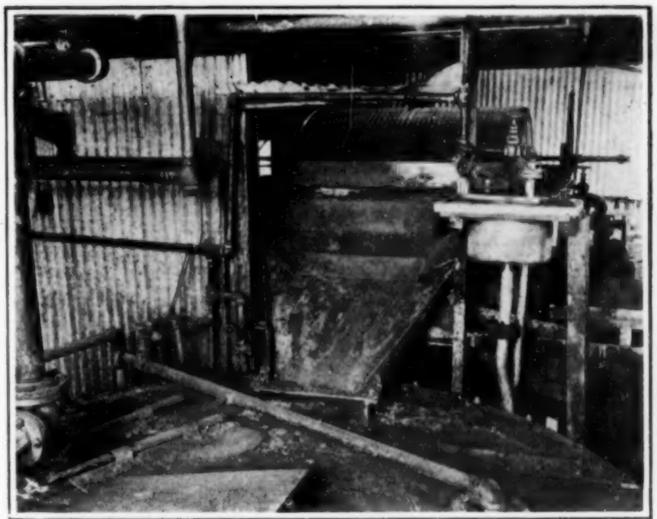


**Fig. 1—Dewatering the Lead Sulphide**
Sulphide cake from the Oliver Continuous Filter drops into an agitator tank in which conversion to sulphate occurs.

diluted with water to 35 to 40 deg. Bé. and allowed to stand for the separation of the admixed tar.

After complete conversion in this tank, the lead sulphate is pumped to a washing tank in which it is brought to an acid content of about 0.5 per cent. The sulphate is now ready to be discharged either to storage or direct to solution tanks in which it is mixed with caustic soda solution to regenerate doctor solution. A summary of the reactions follows:

$$\underset{\text{doctor}}{Pb(OH)ONa} + \underset{\text{hydrogen sulphide}}{H_2S} = \underset{\text{lead sulphide}}{PbS} + \underset{\text{caustic soda}}{NaOH} + H_2O$$

$$\underset{\text{lead sulphide}}{PbS} + \underset{\text{sulphuric acid}}{H_2SO_4} = \underset{\text{lead sulphate}}{PbSO_4} + \underset{\text{hydrogen sulphide}}{H_2S}$$

$$\underset{\text{lead sulphate}}{PbSO_4} + \underset{\text{caustic soda}}{3NaOH} = \underset{\text{doctor}}{Pb(OH)ONa} + \underset{\text{sodium sulphate}}{Na_2SO_4} + H_2O$$

The principal advantages of the process are: (1) Nearly total recovery of the lead, (2) Recovery of from 75 to 80 per cent of the caustic soda, (3) Partial utilization of sludge acid, (4) Recovery of all gasoline drawn off with the lead sulphide, (5) Reduction of labor cost in handling drums of caustic soda and

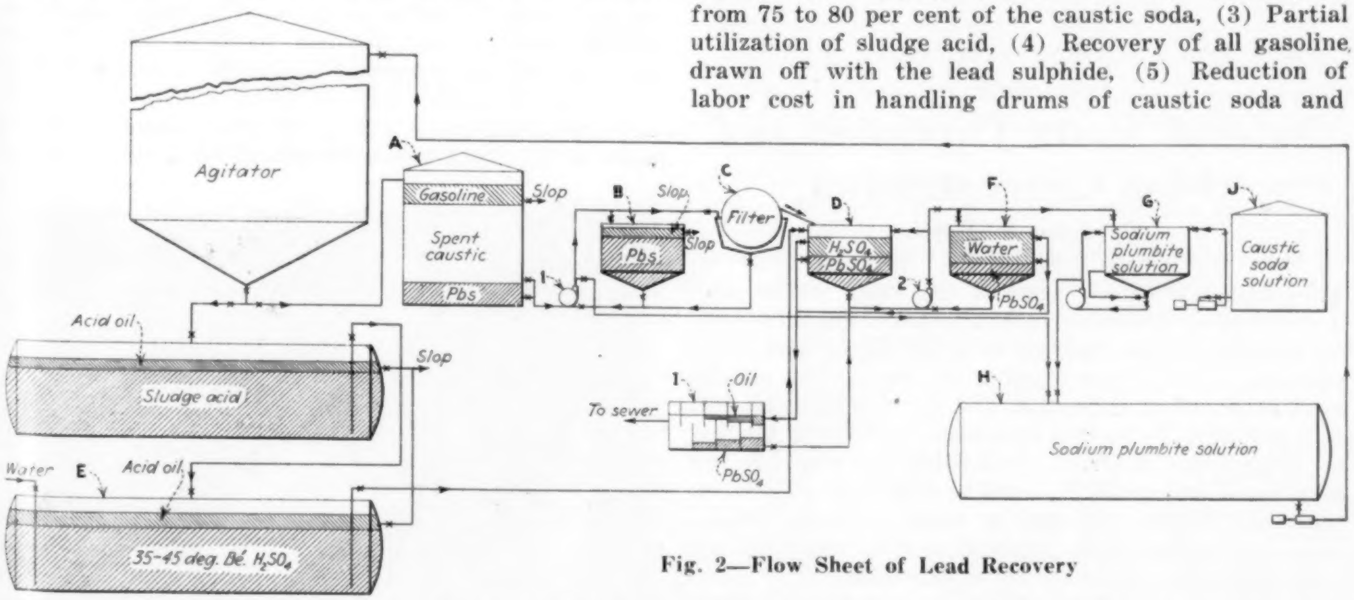



**Fig. 2—Flow Sheet of Lead Recovery**

Spent sodium plumbite solution is drawn from the agitators into storage tank *A* where it is heated by a steam coil and settled. Gasoline rises to the top and is pumped to rerun. The clear solution of spent caustic soda is pumped to sodium plumbite storage tank *H*, and the same pump (1) draws the settled PbS into tank *B* from which it is fed to the continuous filter *C*. Cake from filter *C* drops into the mixing tank *D* where it is agitated by a circulating pump (2) with an excess of diluted sludge acid drawn from tank *E*. When all the PbS has been converted to $PbSO_4$, the contents of tank *D* is pumped to tank *F* where the $PbSO_4$ is washed neutral with running water. The wash water passes through settling box *I* where any oil and $PbSO_4$ is separated and recovered. Lead sulphate from tank *F* is then pumped into tank *G* where it is mixed with caustic soda solution from tank *J*, thus regenerating sodium plumbite. The contents of tank *G* is then pumped to tank *H* to be used again in the agitators.

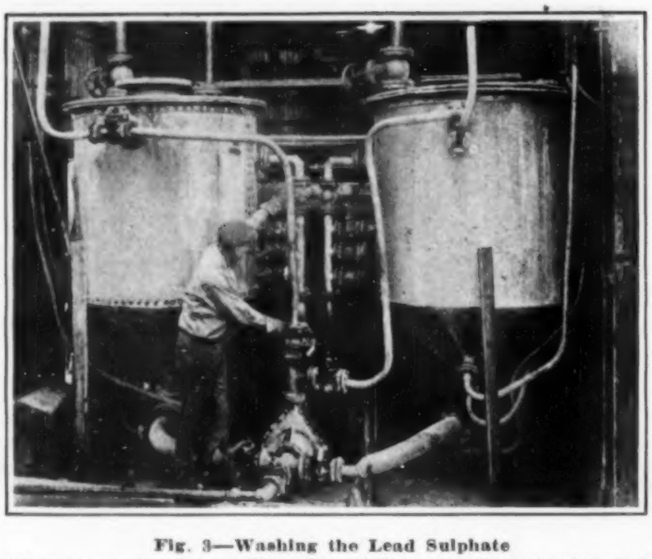


**Fig. 3—Washing the Lead Sulphate**
After conversion is complete, the acidic suspension of sulphate is pumped into conical tanks and is washed.

litharge, (6) Greater solubility of lead sulphate as compared with litharge, and (7) Elimination of the lead poisoning hazard.

Most refineries use at least 500 lb. of litharge per day. A plant designed to recover this quantity would cost about $6,000, this varying with location and conditions at the refinery. Total operating and fixed charges for such a plant would be about $5 per day, and the process would show the following savings:

| | |
|---|---|
| Lead recovered, calculated as PbO, 500 lb. at 12½c.... | $62.50 |
| Caustic soda (corresponding to 500 lb. PbO), on basis of 80 per cent recovery, 2,400 lb. at 3½c........... | 84.00 |
| Total saving on chemicals........................ | $146.50 |
| Total operating costs and fixed charges on plant.... | 5.00 |
| Net savings per day ............................ | $141.50 |

The following calculations disregard the possible savings in gasoline that can be recovered from the spent doctor solution. This saving can easily be $20 per day on a plant of proportionate size.

The Litharge Recovery Corporation of Boston, Mass., has been formed to license the process to oil refiners.

# Natural Water Corrosion and H-Ion Concentration

**By John R. Baylis**
Principal Sanitary Chemist, Baltimore Water Department

IN ORDER to clarify some of the many factors that might affect corrosion rates, this Department has been conducting a large number of experiments within the past few years. Since starting the work many articles have appeared on corrosion, and the fundamental factors now seem to be well established. Nothing tending to disprove the electrochemical theory of corrosion has been found and our work tends to support it. However, there are factors reported as being of minor importance that are of major importance after the metal has been exposed to the water for a long time.

According to the work of several authors, we should expect a concentration of over 3 p.p.m. of soluble iron to exist in a solution free from oxygen when metallic iron is present, and when the pH is between 8 and 9. With a large number of tests, many of which are not plotted on account of falling on the same point as others, this assumption was not confirmed. Undue care was used and some of the tests stood for about 4 weeks, yet the results were the same. In fact no compound of iron gave a soluble concentration of 3 p.p.m. of Fe at a pH between 8 and 9.

The solubility of ferrous carbonate is of considerable interest, for it largely determines whether the water after passing through the iron pipes of our public water supplies will or will not stain. Furthermore, there is another factor not generally recognized in determining corrosion rates, and that is the effect of pH on oxidation rates. A certain amount of soluble iron in water containing an excess of dissolved oxygen will oxidize at a very much faster rate at a pH of 9.0

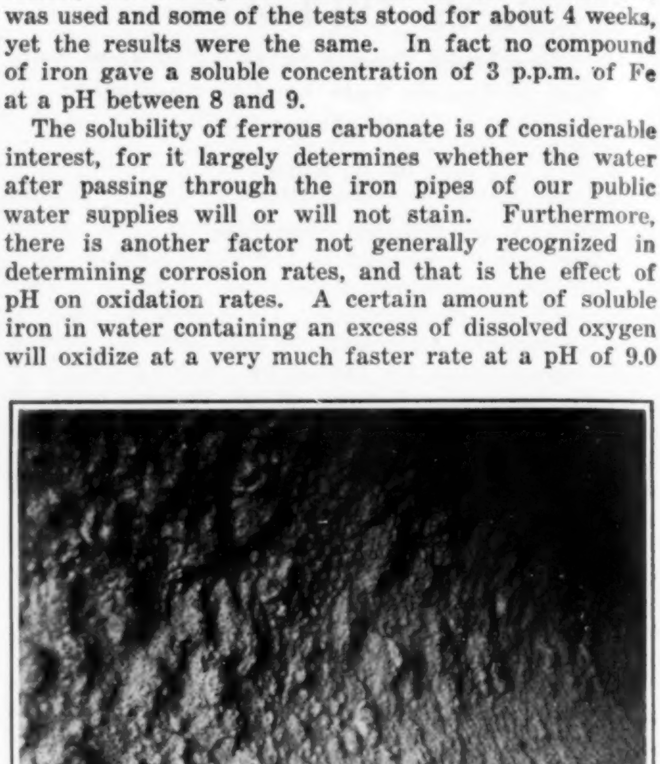


**Fig. 1—Tubercles on Inside of 40-Inch Cast-Iron Water Main Which Has Been in Service 35 Years**
Until the past few years of service the pipe was exposed to water fairly corrosive to iron. Virtually all corrosion has been stopped by treating the water forming an impervious coating over the tubercles

than it will at a pH of 6.0. Anyone who has treated a public water supply with sulphate of iron is fully aware of this.

A large number of tests have been made of the amount of soluble iron which will exist at certain pH values. The concentration of alkaline salts varies the results, and to illustrate the point an alkalinity of 50 p.p.m. will be assumed. If the pH is 9.0, less than 0.1 p.p.m. of soluble iron is found in the absence of dissolved oxygen. A pH of 8.0 gives about 0.1 part, a pH of 7.5 about 1.0, and a pH of 7.0 about 4.0 parts

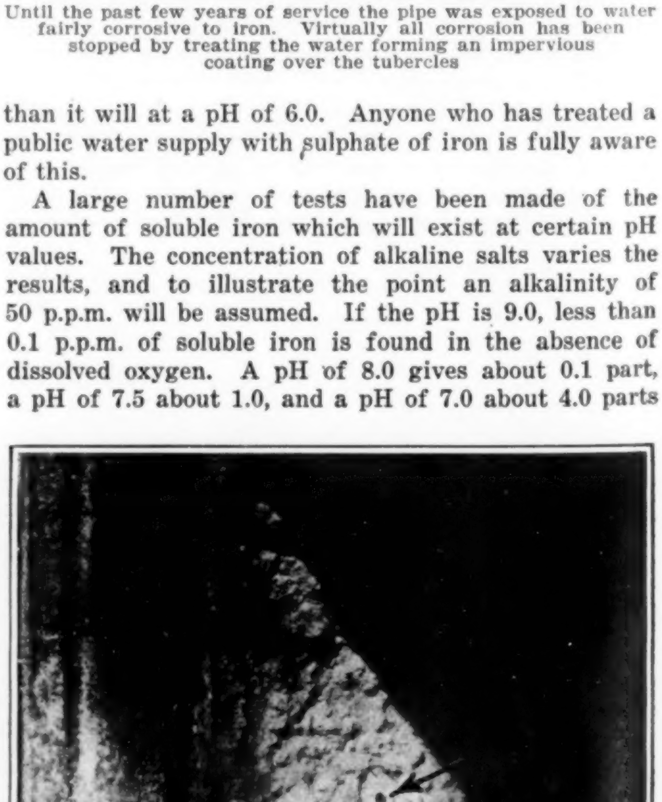


**Fig. 2—Pit Underneath Tubercle on 40-Inch Cast-Iron Pipe**
Underneath each tubercle shown in Fig. 1 is a pit varying in depth from one-eighth to one-half inch. The arrow shows where a tubercle has been removed—exposing a pit about three-eighths inch deep

of soluble iron. Below a pH of 7.0 the soluble iron increases rapidly.

There is a natural tendency for tubercles to form an impervious coating near the surface exposed to the water. This is at the point where the soluble iron from the interior comes in contact with dissolved oxygen. If the water is slightly acid, say a pH of about 6.0, the oxidation rates are slow and there is a tendency for much of the soluble iron to diffuse into the water outside of the tubercle and be carried away from the point where corrosion is taking place. If the water is alkaline, having a pH value of about 8.5, nearly all of the soluble iron will be precipitated at the surface of the tubercle and within a few months will form an impervious coating of a crystalline oxide of iron. It, of course, is impossible for tubercles to form so large as those shown in Fig. 1 when exposed to the alkaline water. If the alkalinity is due to calcium carbonate or bicarbonate and the pH is adjusted to where the water tends to precipitate calcium carbonate, it will also aid greatly in preventing corrosion and tuberculation. This is in addition to the natural tendency of corroding iron to protect itself when in alkaline water.

A large part of our work has been trying to determine the causes for pitting. Pits have been found to be concentration cells in which the negative ions such as sulfates and chlorides are concentrated. In many instances over one per cent of the weight of the tuberculations overlying pits has been found to be composed of sulphates and chlorides of iron. The solution on the inside of an active pit has a pH close to 6.0 regardless of what it may be in the surrounding solution. This has been checked up on a large amount of cast iron pipe that has been in service for 35 years.

Work is actively under way in an attempt to obtain more information as to the action of some of the factors affecting corrosion rates. We have materially reduced corrosion of the iron pipes in Baltimore and "red water" complaints are a thing of the past with us.

# Preparing Asphalt for Roofing Manufacture

By R. A. Hastings
Industrial Gas Department, Public Service Co. of Northern Illinois

OF THE TWO CHIEF INDUSTRIES involving the processing of asphalt, viz., the manufacture of roofing and the preparation of asphaltic paving materials, the former presents the greater difficulties in the application of heat. At excessively high temperatures the asphalt cracks, yielding a deposit of carbon that acts as an insulator to further heating. Furthermore the presence of moisture causes foaming, which unless effectively controlled, produces a fire hazard due to the flammable nature of the vaporized material. These difficulties experienced in the preliminary melting and heating of the asphalt also find their consequences in the application process, causing the burning of the felt base in the saturating tank, uneven coating, etc.

Recent efforts in a number of roofing plants have been concentrated on the use of gas as the heating agent and because of its greater flexibility it has given almost thermostatic control to the process. The still shown in Fig. 1 is a successful application of gas firing. The tank is 8 ft. in diameter and 22 ft. long, having a

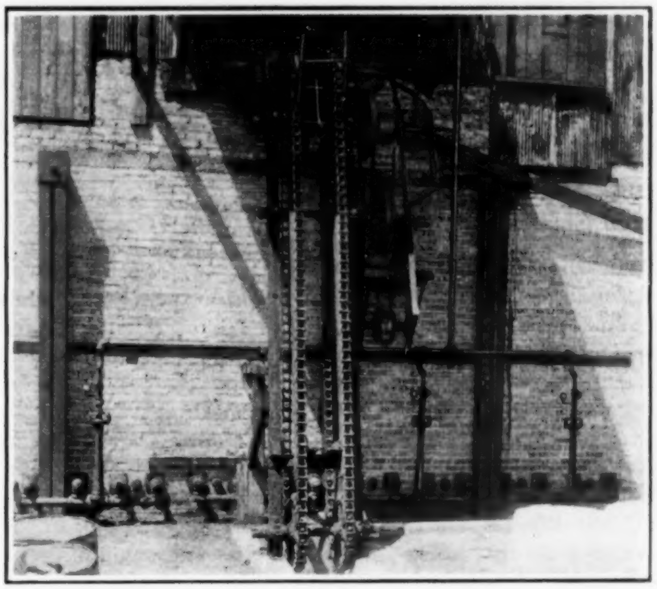


**Fig. 1—Side View of Gas-Fired Asphalt Still**

The automatic hoisting equipment shown in the foreground is used for charging the still with solidified asphalt. At the base will be noted high-pressure gas burners, arranged in units of four to increase flexibility of control.

working capacity (when 80 per cent full) of 6,600 gal. High pressure gas burners, supplied by the Surface Combustion Co. are mounted along one side of the still setting and fired directly into the pockets of refractory. The cross-section of the setting is shown in Fig. 2. A reflected heat is directed around the lower semi-circumference of the tank by means of a properly designed fire wall. This fire wall serves a double purpose in insuring uniform distribution of the heat to the exposed surface of the tank and in increasing the heat transfer by lengthening the travel of the hot gases around the tank.

The temperature of the tank is accurately controlled at 400 deg. F. which is practically 100 deg. below the flash point of the asphalt. This control eliminates the fire hazard and also gives a uniform and, therefore, superior product for the application process. Gas is fired with a minimum of labor and supervision. The tendency of its price is downward and the manufacturer is not dependent upon fluctuating markets nor uncertain deliveries. Using gas the cost of applied heat is approximately 7 per cent of the total cost of producing a roll of finished roofing. Heat processing is, however, a governing factor from the standpoint of quality and it is not practical to use inferior fuels.

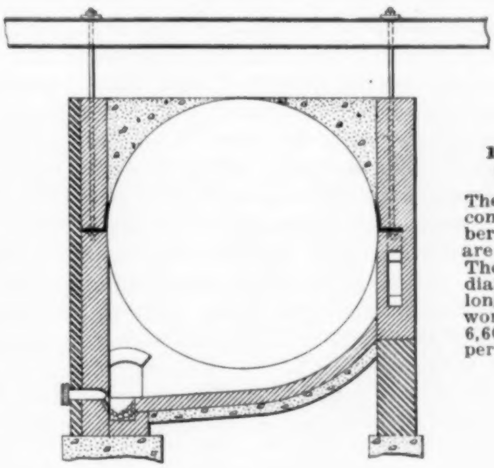


**Fig. 2—Section Through Still**

The burner entry, combustion chamber and flue area are shown here. The tank is 8 ft. in diameter and 22 ft. long, and has a working capacity of 6,600 gal. when 80 per cent full.

# Recent Legal Decisions

**Digest of typical cases decided in high courts, illustrating principles of law applied to business transactions**

### Fire Sprinkler Dealers Not in Illegal Combination

In the case of Berenson vs. H. G. Vogel Co., the defendant denied liability for an automatic fire sprinkler system, claiming that the contract under which it was purchased was illegal and void, on the ground that when made, and during its performance, defendant with other dealers in sprinklers was engaged in an illegal combination forbidden by the Sherman Act. The members of six companies, including defendant, were the officers, directors and stockholders of the Fire Protection Survey Bureau, the object of which was to reduce the cost to the six companies of obtaining information necessary to submit bids on prospective work. When the Bureau received an order for a survey the engineer of the Bureau would make the survey which, with other information, would be sent to the member requesting it. The Bureau did not concern itself with prices or inform one bidder of the estimate made by another bidder. The six companies also were members of the National Automatic Sprinkler Association which disseminated trade information on technical, mechanical or engineering practices. Neither the Bureau nor the Association followed the open competition plan or acted in any way for the purpose of dividing business among the companies, or to encourage collusive bidding.

The Supreme Judicial Court of Massachusetts decided that the Vogel Co. with other dealers in sprinklers was not engaged in an illegal combination in restraint of trade in violation of the Sherman Act.

### Workmen's Compensation Act Not Always Applicable in Accident or Death

In a case recently decided before the Court of Appeals in New York one Lerner, by remaining in his employer's refrigerator for 10 minutes in the performance of his duties, received a chill that caused a cold which subsequently resulted in a disease causing his death. The question was whether his death was due to an accidental injury arising out of his employment within the meaning of the workmen's compensation law. The Court held that the claim should be dismissed. Two concurrent limitations have been placed on the right to recover an award when a disease not the natural and unavoidable result of the employment, is developed during the course of the employment. First, the inception of the disease must be assignable to a determinate or single act identified in space or time. Secondly, it must also be assignable to something catastrophic or extraordinary. The exposure although occurring at a definite time and place was not catastrophic or extraordinary.

In a quite different case decided by the Supreme Court of Illinois the plaintiff was a mine examiner employed by a coal company. His duties were to examine the mine at night and make such repairs as would make the mine safe for miners. The coal company furnished him with a mule and coal car with which to travel through the mine. The mine contained electric motors but the examiner had been instructed not to use them, and the company's rules forbade their use by any except those who were employed to operate them. In violation of the rule the mine examiner took a motor out of the pit for the purpose of going into the mine. The motor ran over him and cut off his leg. The Industrial Commission awarded him compensation but the Supreme Court held that the award should be set aside. In attempting to operate the motor the employee voluntarily went outside the reasonable sphere of his employment. To entitle an employee to compensation the injury must occur in the course of and arising out of the employment.

### Claim for Federal Taxes Not Barred by Failure to File Before a Specified Date

The Collector of Internal Revenue appealed from an order of the Superior Court, Illinois, directing the receiver in charge of the property of the insolvent General Combustion Co. to "reject, disallow and disregard" the Collector's claim for federal taxes. An order had been entered requiring all persons having claims against the insolvent company to file them on or before a specified date or else be forever barred from filing such claims. The United States had a claim against the corporation for income taxes which was not filed within the time fixed. Assets of the insolvent corporation were undistributed at the time the order of the Superior Court was entered. The Appellate Court of Illinois, first district, held that the order of the Superior Court should be reversed. The Federal Government may present its claims for taxes at any time during the pendency of receivership proceedings or before the assets are distributed. The United States is not bound by any statute of limitations in a suit brought by it as a sovereign government to enforce a public right or to assert a public interest.

### Must Procure Permit Before Purchasing Intoxicating Liquors

W. L. Weller and Sons, wholesale liquor dealers in Louisville received via Western Union Telegraph Co. a telegram purporting to be from their New York agent stating that the latter had sold 1,000 cases of Tucker whiskey. The dealer did not have on hand that much Tucker whiskey and relying upon the authenticity of the telegram bought from another wholesale dealer 600 cases of Tucker whiskey to fill this order. Subsequently it was ascertained that no such message had been sent by the New York agent and the Louisville dealer brought action against the telegraph company to recover a loss sustained in disposing of the 600 cases of whiskey. The evidence showed that loss was caused by the telegraph company's negligence but the trial judge held that the plaintiff liquor dealer could not recover because it had no authority to purchase the whiskey, due to its failure to get a permit from the prohibition authorities. The Court of Appeals of Kentucky subsequently sustained the trial court and maintained that the plaintiff was not entitled to recover. While no permit is necessary for the purchase and sale of warehouse receipts covering distilled spirits in government bonded warehouses, a permit must be obtained before purchasing as well as before selling the actual spirits themselves.

# On the Engineer's Book Shelf

## Advanced Chemical Theory

A SYSTEM OF PHYSICAL CHEMISTRY (in 3 vol.). Vol. II: Considerations Based on Thermodynamics. By *W. C. McC. Lewis*, Professor in the University of Liverpool. Fourth Edition. Longmans, Green & Co., New York. 489 pp. Price, $4.75.

**Reviewed by George L. Clark**

The test of the real value, quality and usefulness of any book, more especially in the field of science, is to be measured not only by the number of editions through which it passes, but also by the corrections or changes which are required from one edition to the next. So exceedingly well did Professor Lewis accomplish his original task in preparing this familiar 3-volume text that 4 editions already (which is a goodly number for pure science treatises), and the extraordinarily few additions and corrections which have been necessitated, are readily explained.

This present edition of the second volume differs from the third edition only in the natural insertion of brief accounts of the most recent valuable contributions to the applications of thermodynamics to chemistry, particularly of the rôle of the thermodynamic concept of "activity," and of Professor A. A. Noyes' paper published in 1924 on the interionic attraction theory (Milner-Debye) of strong electrolytes. New researches during the past few months, particularly the experimental verification of the Debye theory as extended by Hückel, taking into account the magnitude of electric charges, the diameters of ions and the changing dielectric constant of solutions, have entirely justified these additions. Otherwise the selection, organization and presentation of material in the previous editions have met every requirement of critical users.

The work is truly a classic. This may be said with particular emphasis of the second volume which covers perhaps the most complex field within the borders of physical chemistry. The world is indebted to Professor Lewis for making possible, almost single-handed, adequate instruction in the predominating and fundamental tendencies in chemistry. To teachers the text is a revelation; prospective doctors of philosophy call it their Bible and go into examinations with the certainty that they are prepared to meet not only the emergency of the moment, but also to know and use always the very heart and philosophy of the science. Details may be forgotten (and found again by reference to Lewis), but the point of view remains. While this is in no sense an elementary text, yet its organization and clearness adapt it even to the beginners' understanding without the preliminary intervention of some imperfect introduction. Some criticism was offered after the first appearance of this series, by some who had elementary instruction in mind, because of the division of the subject in the 3 volumes into Kinetic Theory, Thermodynamics and Quantum Theory. Subsequent research developments and the solid experience of thousands of readers and students have justified this classification completely.

## Digest of Coal Liquifaction

THE CONVERSION OF COAL INTO OILS. By *Franz Fischer*, director of the Kaiser-Wilhelm Institute for Coal Research, Mülheim-Ruhr; professor at the Technical High School, Berlin. Authorized English translation edited with a foreword and notes by *R. Lessing*, consulting chemist and chemical engineer; honorary secretary of the Coal Research Club. D. Van Nostrand Company, New York. 284 pp. Price, $8.

During the past 10 years, no less than 200 important papers on the chemistry of coal have appeared. This is some indication of the great technical interest in coal carbonization and allied problems, the results of which may change the entire economic aspect of coal, thus forming the basis of an enormous new chemical industry.

The carefully controlled low-temperature carbonization of coal to make primary tar, forms about three-fifths of the subject matter of the book and hydrogenation and synthetic processes occupy most of the remainder. Extraction processes, and liquefaction through carbides are discussed rather briefly, but with as much attention as is probably deserved.

The author thoroughly establishes a case for the production of primary tar supplemented by synthetic processes, as complete conversion of the coal into heavy and light oils is thereby possible. The only competing process discussed is that of Berguis, but this lacks the economic flexibility afforded by primary tar production and synthol combined.

Aside from being a digest of the worth-while literature of coal liquefaction, the book contains several hitherto unpublished papers by Fischer on synthetic processes. Altogether it is a work commensurate with the distinguished author's past accomplishments, and it is an authoritative and much-needed contribution to fuel technology.

## Economics of Mineral Industry

NON-METALLIC MINERALS OCCURRENCE—PREPARATION—UTILIZATION. By *Raymond B. Ladoo*, general manager, Southern Minerals Corporation; technical director, Eastern Magnesia Talc Co., Inc. McGraw-Hill Book Company, Inc., New York. 686 pp. Price $6.

The correspondence that daily comes over the desk of an editor is a good index of the kind of information wanted in a given field; and this in turn reflects on the literature of that branch of technology. Experience has shown that interest in the occurrence, preparation and utilization of non-metallic minerals is forever at a high ebb. Ladoo's book, which includes over 100 commodities, and which is the product of an author singularly qualified for writing it, is bound to be popular with engineers, research workers and editors.

THE MARKETING OF METALS AND MINERALS. A Series of Articles by Specialists. Edited by *Josiah Edward Spurr*, editor, *Engineering & Mining Journal-Press*, and *Felix Edgar Wormser*, assistant editor, *Engineering & Mining Journal-Press*, McGraw-Hill Book Company, Inc., New York. 674 pp. Price $6.

In seeking sources of supply and market outlets for various metal and mineral commodities, the chemical

engineer wants to know about prices, sales and uses. Very often such information is necessary in the projection of new processes. Up to the present, however, there has been no single source of market information in this field, and the present book unquestionably will satisfy nearly every requirement, as 48 specialists have collaborated on the marketing of 94 important metals and minerals. It is safe to say that no other book contains such complete market data, and edited in such an able manner.

## New Special Libraries Directory

SPECIAL LIBRARIES DIRECTORY. Second Edition. Compiled by *May Wilson*, librarian, the Merchants Association of New York; edited by *Rebecca B. Rankin*, librarian, Municipal Reference Library, New York City; and with an introduction by *John Cotton Dana*, librarian, Newark Free Public Library. Special Libraries Association, New York. 254 pp. Price $4.

The directory contains the subject headings of about 800 special libraries, of which 26 are chemical and 27 are engineering collections. A glance at the contents pages indicates the intense interest in the special library —the right hand "research department" of thousands of business and professional men, administrators, manufacturers and scientists. Such a compilation might well be called the key to the treasure stores of knowledge.

## Chemistry Texts for Colleges

AN INTRODUCTION TO THE PRACTICE OF ORGANIC CHEMISTRY IN THE LABORATORY. By *Homer Adkins*, associate professor of Chemistry, University of Wisconsin and *S. M. McElvain*, University of Wisconsin. McGraw-Hill Book Company, New York. 288 pp. Price $2.25.

The authors of this book have produced something more than a mere laboratory manual. In addition to outlining more than 100 organic preparations, nearly one-half of the total space is devoted to a lucid discussion of the important reactions of organic chemistry, and to the principles of laboratory technique. A particularly commendable chapter is that on the literature of organic chemistry, directing the student to the principal sources of book and periodical information.

INTRODUCTION TO QUALITATIVE ORGANIC ANALYSIS. By *Hermann Staudinger*, professor of inorganic and organic chemistry, and director of the laboratory for general and analytical chemistry at the Federal Technical College, Zürich; authorized translation by *Walter T. K. Braunholtz*. D. Van Nostrand Company, New York, 112 pp. Price $2.50.

This book is a distinct departure in organic laboratory instruction, as the exercises are not based on synthesis, but upon a scheme of analysis, similar in purpose to the conventional scheme of qualitative inorganic analysis. That such a plan has long been needed is evidenced by the lack of skill in this branch of analysis shown by most chemistry graduates. The present book is a good pioneer publication in a difficult field.

INORGANIC QUANTITATIVE ANALYSIS. By *Harold A. Fales*, associate professor of chemistry at Columbia University. The Century Co., New York. 493 pp. Price $3.50.

The present book on quantitative analysis is unique. It is neither a skeleton of methods, nor a weighty reference work replete with the subject matter of inorganic chemistry. The author has combined successfully the teaching of quantitative methods and technique with the related principles of physical chemistry. A surprisingly large number of references appear.

COLLEGE CHEMISTRY. By *Lyman C. Newell*, professor of chemistry, Boston University. D. C. Heath and Company, Boston. 645 pp. Price $3.

There are so many good text books of college chemistry that radical departures in plan are not to be expected. But there is yet considerable latitude in method of presentation, and Dr. Newell has succeeded in producing a readable book that shows the important tie between chemical science and industry. It can be recommended to those who would refresh their past knowledge of general chemistry and at the same time keep up with later progress.

## An Important Revision

A TEXT BOOK OF ORE DRESSING. By *Robert H. Richards*, professor emeritus of mining engineering and metallurgy at the Massachusetts Institute of Technology, and *Charles E. Locke*, associate professor of mining engineering and ore dressing at the Massachusetts Institute of Technology, assisted by *John L. Bray*, professor of metallurgy, Purdue University. McGraw-Hill Book Company, Inc., New York. 570 pp. Price $5.50.

The first edition of "A Text Book of Ore Dressing," published 16 years ago, has earned for itself such favor that little need be said of the merits of this second completely revised edition. Recent advances in flotation, graded crushing, classification, coal washing, and concentration are discussed critically, and the book should be used by the chemical engineer as a reference in these important preliminary unit operations that so often form a part of chemical manufacturing.

## Chemistry and Civilization

CHEMISTRY AND CIVILIZATION. By *Allerton S. Cushman*, director, Institute of Industrial Research, Inc., Washington, D. C., Ex-Lieut.-Col. Ordnance Department, U. S. A. E. P. Dutton & Company, New York. 171 pp. Price $2.50.

**Reviewed by Chaplin Tyler**

Technologists and laymen alike will read Dr. Cushman's book with keen enjoyment, as for the most part it is written in excellent style, and the author has succeeded in proving the vital importance of chemical science to modern civilization. The clear exposition of chemical theory in everyday English—always a difficult task, is exceptionally well done.

It is to be regretted however that several misleading statements have been made, of which the following are illustrative. On p. 74, the author says:

> Moreover, camphor is needed to make artificial leather, and artificial leather is necessary to make Ford cars.

As far as we are aware, camphor does not enter into the present-day processes for making artificial leather. And again, on p. 91, we find that:

> The famous so-called mustard gas which produced such terrible suffering was in no way related to mustard but was a coal tar product of a complicated molecular structure.

To call mustard gas "a coal tar product" is hardly in accordance with accepted nomenclature.

Of minor errors, there is a generous sprinkling. On p. 47, Newcastle is "New Castle"; on p. 58, Le Blanc or Leblanc is "Le Banc"; on p. 79, Oppau is "Appau"; on p. 94, we find that charcoal may be "finer-poured"; on p. 95, Dr. Carrel becomes "Dr. Carrell"; on p. 116, Bâle is "Bale"; and in at least eight places Mendelejeff or Mendelyeev is "Mendeleeff" or "Mendeleef."

# Readers' Views and Comments

***An Open Forum***

**The editors invite discussion of articles and editorials or other topics of interest**

## Dephlogisticating the Motor Exhaust

*To the Editor of Chem. & Met.:*

Sir—While perusing casually the September, 1925, number of *Motor Land*, the publication of the California State Automobile Association, my eye was caught by the following caption: "Evils of Motor Exhaust Doomed," Subjects of this nature, surely always of general interest, often prove of specific interest to—say, a reader of *Chem. & Met.* So I read on.

The sub-caption amplified that the fate of the exhaust would be its extinction. The opening sentence,

> Abolition of the automobile exhaust is the next step in automotive improvements.

struck a responsive chord in my harmonium, which includes in its repertoire a wholesome respect for epoch-making changes. So I waded in.

It seems that the exhaust of an automobile has reached its limit. This limit is "absolute menace." It had been approaching the limit for some time. Gasoline dopes have hastened the arrival. The exhaust must be cleaned, from which it dawned upon my consciousness that the evils are to be eliminated by ablution rather than by abolition. Specifically, there is a

> demand for a device that will eliminate effectively the carbon monoxide from the exhaust fumes.

So it is to be a mechanical device. Surely, for the modus operandi is

> straining or filtering out the poison from the exhaust fumes.

> Just as a neck in the drain pipe of the wash stand is designed to trap dirt, so is it possible that a trap in the exhaust pipe might serve to retain the poison elements of the exhaust fumes.

Then,

> A pipe twice as long as the present type (of wash stand drain pipe?) undoubtedly would catch much of the tetraethyl lead being expelled by motors using fuel containing this compound, thereby preventing it from reaching the street where it might be blown by the wind into the systems of pedestrians.

Thus, only a portion of the tetraethyl lead could reach the street, thence possibly to be wafted by the zephyrs into a final resting place within inflated pedestrians. But be this as it may, it is certain that

> if a special type of muffler

could trap poisons from out of the fumes, as dirt is removed by the air cleaner from the air entering the carburetor,

> every automobile . . . would then be an air purifier instead of an air contaminator, and the vision of the population of our avenues and boulevards going mad from lead poisoning would have to be altered.

The inference is that if the proposed special muffler could properly trap, the lead maddened mob swarming the thoroughfares would have to look at things differently after inspiring the freshly renovated air.

> If an automobile engine draws in air simply to assist the fuel in the combustion process why can't it exhaust pure air after the process is complete?

I'll bite! Why not? But there, I have it! The matter is completely dephlogisticated. Air is only an aid to combustion in the sense of a pair of crutches. When you get through with 'em pass 'em along to the next unfortunate.

Now it becomes clear to me how the exhaust is to be abolished. If the motor is made to exhaust pure air, dispense with the air cleaner, the exhaust, the muffler, everything except the special muffler. The pure hot air puffing out of this device need but to be led back to the carburetor to convey new gas into the motor. The cycle is complete. The back-pressure will actually co-operate with the north end of the motor rather than interfere with its south end. The next step will be to regenerate the gas and then to have Congress amend the present thermodynamic legislation to suit the case.

I am a bit hazy as to the exact meaning of the final sentence in the article:

> It is about time that the exhaust were abolished in favor of something that will permit the use of the newer fuels which have already demonstrated their ability to make use of the high-compression, high-efficiency engine possible.

If some kind-hearted person will translate this for me and "adulterate" it with an anti-knocking compound, I will give him a nice two-cylindered fireless cooker I have decided to dispense with. WALTER J. HUND.

San Rafael, California.

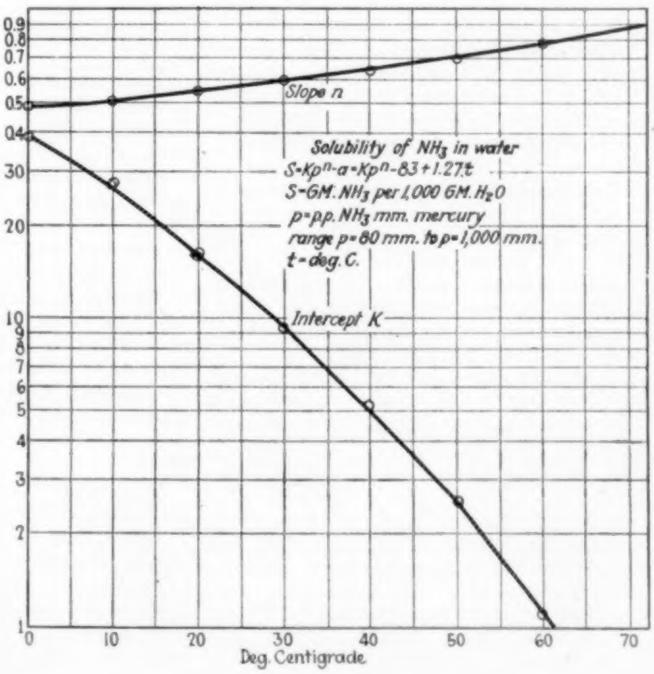
## Absorption of Ammonia

*To the Editor of Chem. & Met.:*

Sir—The graph and formula appearing herewith refer to "formula No. 2," mention of which was made on pp. 704-5 of your August, 1925 issue.

T. K. SHERWOOD.

Boston, Mass.



# Recent Articles in Technical Periodical Literature

By P. K. Frölich
Massachusetts Institute of Technology

**Scrubbing of Gases.** Modern equipment for scrubbing of gases. Cont. G. Weissenberger. *Chem. Apparatur*, 1925, vol. 12, pp. 170-2.

**Liquid Fuel.** Review of the various processes for production of liquid fuel for internal combustion engines. Cont. M. Brutzkus, *Chimie & industrie*, 1925, vol. 14, pp. 358-63. Also the possibility of obtaining gasoline from animal oils. E. André, *ibid.*, pp. 371-3.

**Distillation of Coal.** Discussion of the economy of the rotating furnace process. M. Dolch, *Brennstoff-Chemie*, 1925, vol. 6, pp. 285-90, 291; Roser, *ibid.*, pp. 290-1.

**Liquefaction of Solid Fuels.** Liquefaction of wood and cellulose and some general remarks on the liquefaction of coal. H. E. Fierz-David, *J. Soc. Chem. Ind.*, 1925, vol. 44, pp. 942-4.

**Gasoline Storage Losses.** Preventing evaporation losses in the refinery. R. E. Wilson and co-authors, *Ind. & Eng. Chem.*, 1925, vol. 17, pp. 1030-35.

**Sugar Industry.** Description of the new Maxwell "crusher-shredder" for handling of cane. Anon., *Inter. Sugar J.*, 1925, vol. 27, pp. 418-22.

**Rayon.** Conditions in the rayon industry throughout the world. Anon., *Die Chem. Ind.*, 1925, vol. 48, pp. 557-8. Also, a review of the chemistry and methods, etc., of the rayon industry. M. G. Luft, *Ind. & Eng. Chem.*, 1925, vol. 17, pp. 1037-42.

**Electrochemical Industry.** Present state of the electrochemical and electrometallurgical industries in France. Anon., *Die Chem. Ind.*, 1925, vol. 48, pp. 589-91; 609-11; 631-2.

**Dicalcium Phosphate.** Manufacture and use of dicalcium phosphate. R. Deckert, *Chem. Ztg.*, 1925, vol. 49, pp. 789-90.

**Radioactivity.** Review of the industry of radiactive substances. C. Matignon and G. Marchal, *Chimie & industrie*, 1925, vol. 14, pp. 343-58.

**Chemical Equipment.** Plea for cooperation between the engineer and the chemist in the design and construction of chemical equipment and apparatus L. Meyer, *Chem. Apparatur*, 1925, vol. 12, pp. 154-5; 183-5.

**Grinding.** New type of grinder utilizing electromagnetic forces for developing pressure. Anon., *Chem. Ztg.*, 1925, vol. 49, pp. 836-7.

**Ethyl Alcohol.** Review of the various methods for the manufacture of ethyl alcohol. Cont. E. Girod, *Rev. chim. ind.*, 1925, vol. 34, pp. 273-6.

**Hydrochloric Acid.** Manufacture of hydrochloric acid from chlorine and steam by passing the gases over coke at high temperature. W. Hirschkind, *Ind. & Eng. Chem.*, 1925, vol. 17, pp. 1071-3.

**Casein.** Casein and its industrial applications (cont.). Applications of casein in the paper industry and in the manufacture of adhesives and cements, plastics and prints. F. C. C. Lynch, *Can. Chem. and Met.*, 1925, vol. 9, pp. 221-5.

**Insecticides.** Results of tests of insecticides during the years 1921-1924. Cont. A. Kölliker, *Chem. Ztg.*, 1925, vol. 49, pp. 774-5; 790-2; 815-17.

### Government Publications

Relation Between Heating Value of Gas and Its Usefulness to the Consumer by E. R. Weaver. Bureau of Standards Technologic Paper 290.

Condensation of Water from Engine Exhaust for Airship Ballasting by R. F. Kohr. Bureau of Standards Technologic Paper 293.

Wearing Qualities of Tire Treads as Influenced by Reclaimed Rubber by W. L. Holt and P. L. Wormeley. Bureau of Standards Technologic Paper 294.

Initial Temperature and Mass Effects in Quenching by H. J. French and O. Z. Klopsch. Bureau of Standards Technologic Paper 295.

General Information for Refiners of Petroleum Regarding Tests of Lubricating Oils at Engineering Experiment Station, Annapolis, Md. Bulletin NSE 31, Engineering Bureau, Navy Department.

Stream Pollution by Wastes from By-Product Coke Ovens, by R. D. Leitch. Public Health Service, Reports Vol. 40, No. 39. Sept. 25, 1925.

Iron and Alloy Metals in Siberia, by B. Baiensky. Bureau of Foreign and Domestic Commerce, Trade Information Bulletin 359.

Possibilities for Para Rubber Production in the Philippine Islands by C. F. Vanee and others, Bureau of Foreign and Domestic Commerce. Trade Promotion Series 17.

French Iron and Steel Industry, by Chester Lloyd Jones. Bureau of Foreign and Domestic Commerce, Trade Information Bulletin 367.

The Manganese Situation of the World, by R. M. Santmyers, Bureau of Foreign and Domestic Commerce, Special Circular 224.

Foreign Markets for American Copper and Brass Products, by R. M. Santmyers. Bureau of Foreign and Domestic Commerce, Special Circular 234, Part I.

Relative Merits of Cotton and Jute Cement Sacks, by Robert J. Morris. Bureau of Standards, Technologic Paper 292.

Effect of Wear on the Magnetic Properties and Tensile Strength of Steel Wire, by Raymond L. Sanford, Walter L. Cheney and James M. Barry. Bureau of Standards, Scientific Paper 510.

Cement Specifications. Revised form of U. S. Government master specification issued as third edition, Circular 33, Bureau of Standards.

National Directory of Commodity Specifications. Miscellaneous publication 65, Bureau of Standards. Price $1.25.

Incomplete Combustion in Natural-Gas Space Heaters, by G. W. Jones, W. P. Yant, and L. B. Berger. Bureau of Mines, Technical Paper 362.

Protection of Oil and Gas Field Equipment Against Corrosion. By R. Van A. Mills. Bureau of Mines. Bulletin No. 233.

Miscellaneous Analyses of Foreign Coals. Bureau of Mines, Serial No. 2708.

Twelfth Semi-Annual Motor Gasoline Survey, by I. N. Beall, H. M. Thorne and John Devine. Bureau of Mines, Serial No. 2703.

Natural-Gas Gasoline Statistics, July, 1925 by G. R. Hopkins. Bureau of Mines, first monthly statement of production and blending statistics.

Census of Manufactures statistical reports: Paints and Varnishes, Bone Black, Carbon Black and Lampblack, 1923; Chocolate and Cocoa Products, Confectionery and Ice Cream, 1923; Motor Vehicles, Motor-Vehicle Bodies and Parts, 1923; Tanning Materials and Natural Dyestuffs, 1923; Annual Census of Clay Products Industries, 1924; Paint and Varnish Production and Sales, 1925 (first half).

### Miscellaneous Publications

A Treatise on Missouri Clays. Published as co-operative work between the State Mining Experiment Station of the Missouri School of Mines and Metallurgy and the Missouri State Geological Survey. Rollo, Missouri.

International Control of Minerals. Studies made by the Committee of the Mining and Metallurgical Society of America on Foreign and Domestic Mining Policy and the Committee of the American Institute of Mining and Metallurgical Engineers on Industrial Preparedness. Published Jointly by the American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America, New York.

Research Investigations for the Year 1924-1925, Including Hydrometallurgy of Lead, Investigations on Utah Hydrocarbons, Flotation Fundamentals and their Application, Surface Measurement on Finely Ground Particles. Bulletin No. 16, Utah Engineering Experiment Station, Department of Metallurgical Research, State School of Mines, University of Utah, in Co-operation with the U. S. Bureau of Mines.

Annual Report for the Year 1924. State of Colorado Bureau of Mines, Denver.

Announcement of the Program in Chemical Engineering and of the Graduate Courses in General Chemical Engineering, Metallurgical Engineering, Gas Engineering, Organic Chemical Industries by the University of Michigan, Ann Arbor.

Standard Specifications and Methods of Test for Materials. By C. L. Warwick. A paper presented at the First Pan-American Conference on Uniformity of Specifications, Lima, Peru, Dec. 23, 1924. Reprinted by the A. S. T. M. with permission of the Director General of the Pan-American Union.

Open Tank Creosoting Plants for Treating Chestnut Poles. By T. C. Smith. An outline of the considerations governing the location of plants and principal features of design, operation, and equipment. Bell Telephone Laboratories, Inc., New York.

Index of Technical Reprints. Technical Reprints by Bell System Engineers, Nos. B-1-1 to B-119-1 and C-1-1 to C-13-1. Bell Telephone Laboratories, New York.

# The Plant Notebook

*An Exchange for Operating Men*

## Some Factors to Be Observed In Welding on Boilers

By S. W. Miller
Past President, American Welding Society

In view of the ever-widening applications of fusion welding throughout industry and the probability that repairs to boilers made in this way will be proposed from time to time, it is well that those responsible for the results should bear several points in mind. For simplicity, these are listed briefly below:

1. Most boilers are insured.
2. Many boiler insurance policies are so worded that if repairs are made without the authority of the company carrying the insurance, the policy becomes void.
3. There are Federal, State and Municipal regulations governing this work, as well as those issued by the insurance companies.
4. Only competent welders, used to boiler work, should be allowed to do the welding.

Therefore, the following precautions should be observed by the owner or his representative:

1. Examine the part of the boiler to be welded in company with the insurance company inspector, and get his approval before doing any welding.
2. Be present at the test after welding with the inspector.
3. If possible, get the inspector to sign a statement that the work has been properly done and that it has passed the test successfully.
4. If the boiler is not insured, and comes under Federal, State or Municipal supervision, carry out the above program in company with the proper authority.

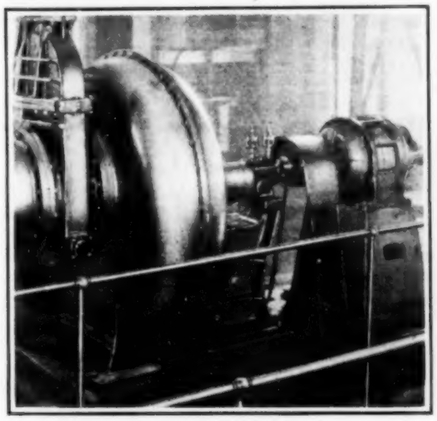
If the boiler is neither insured nor under supervision of some constituted authority, ample precautions should be taken by the welder and the owner to protect themselves against possible future trouble. They should make a sketch of the location and size of the repair, with a clear statement of what was found wrong and how the repair was made. They should always make a hydrostatic hammer test of the finished job, using a pressure of 1½ times the working boiler pressure, in the presence of witnesses, and get their signature to a statement of the facts. These papers should be carefully filed away. In such a case, no welding should be done which is not permitted by law or by good practice.

In case of marine work, the welder should pass the regular examination of the Federal Steamboat Inspection Service.

In all cases, the welder should make friends of the insurance and other inspectors by refusing to do work unless authorized by them, by being conservative in what work he recommends, and by doing nothing except a first-class job.

## A Safety Protector for Flexible Couplings

The links in a flexible coupling, between a high-speed electric motor and pump or blower, for instance, may be



Shield for High-Speed Coupling

flung off with considerable force in the event of breakage. The accompanying illustration shows a simple safety device, of rod iron and steel plate, which prevents such accidents. It is bolted to the base plate and can be removed quickly when repair work has to be done.

## Reducing the Corrosion of Fume Hoods

One large chemical plant uses several processes that employ open finishing kettles provided with a partial cover and a stack to take away the fumes which at times are quite corrosive. Formerly these hoods were installed with the stack over the center of the kettle. In front were openings for inspection by the operator, while the rear end was made fairly tight to prevent leakage of fumes into the room.

When the stacks were moved to a position over the rear ends of the kettles, the hoods lasted considerably longer than before. This was because the natural draft of the stack draws a large quantity of air through the openings at the front of the hood. This air dilutes the corrosive fumes and makes them easier to handle without their causing corrosion. The fumes over the rear of the kettles, as the hoods were formerly constructed, did not get this dilution and consequently the rear of the hoods was corroded more quickly. This suggestion may be of value to others who can reduce corrosion by diluting corrosive fumes.

## Inexpensive Filter Prevents Clogging of Water Mains

R. L. Grimes, in *Coal Age* for July 30, 1925, describes a method for keeping water pipe-lines free from obstructing deposits due to hardness of the water. This method employs a home-made filter made from a piece of 10 or 12 inch pipe 10 ft. in length. A flanged coupling is threaded on each end of this pipe and end plates are made to bolt to each of these couplings. A hole is drilled and tapped in each of these end plates to accommodate the water line and the whole device is installed in this line at an appropriate point between the water tank and the point of water utilization.

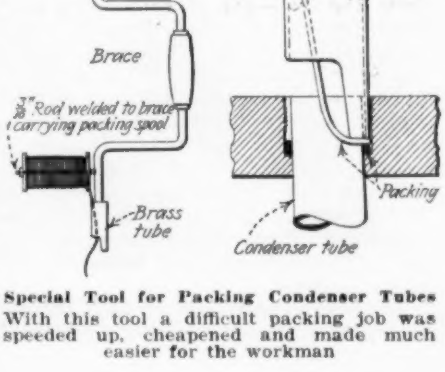
The length of large diameter pipe is filled with ordinary coarse slag. This slag is porous and rough and the impurities in the water that would otherwise deposit on the walls of the pipe are collected by it. From time to time, the slag must be renewed, but as it is an inexpensive material this makes little difference.

## Special Tool for Packing Condenser Tubes

By Maurice C. Cockshott
Engineering Department, Emsco Steel Products Co., Los Angeles, Calif.

Having once been in charge of a plant where it was often necessary to retube small auxiliary condensers, I found that the method of packing the tubes by means of wires sharpened and bent, slowly and laboriously forcing the packing in around the tube end, in the stuffing box, was taking far too much time, as well as being most costly.

We had no means of doing this by a special machine, having only an average machine shop, so I devised a means of expediting this job as follows: I had a brace made much the same as a carpenters drill brace, except that the




**Special Tool for Packing Condenser Tubes**

With this tool a difficult packing job was speeded up, cheapened and made much easier for the workman

shank, or part where the chuck would be was made longer, and a piece of brass pipe was soldered on to the end This pipe was of large enough diameter so that it would easily fit over the condenser tube, yet would fit into the small stuffing box; in other words, an easy fit between the two was made. The end was sawn across, and the corners filed down as shown in the accompanying sketch.

Above the brass pipe on the shank of the brace a $\frac{3}{16}$-in. steel rod was welded at right angles to the shank, one end being screwed and fitted with a nut and washer. The packing used was bought at a dry goods store, and was an article of ladies apparel, corset lacing. This was soaked in tallow and graphite and was then wound onto a spool which was carried on the small rod. The end of the thread was carried down inside of the brass tube, through a small hole next to where the spool was carried, and so to the end of the bit, or packing tool.

This tool was then inserted in the space between the tube and tube plate, and the packing so placed that on revolving the brace, the end of the tool carried the material around with it, and forced it into place. The only trouble encountered was in getting the edge of the packing tool to have the right radius to carry the packing around with it. However, one or two trials accomplished this, and as long as the spool revolved freely the packing was tightly laid in place. The amount of packing to lay was found by practice. Also the amount of weight to put on the brace was determined. This latter must not be so great as to cause over-runs instead of laying the packing in the proper place.

## Sampling Malleable Iron Heats

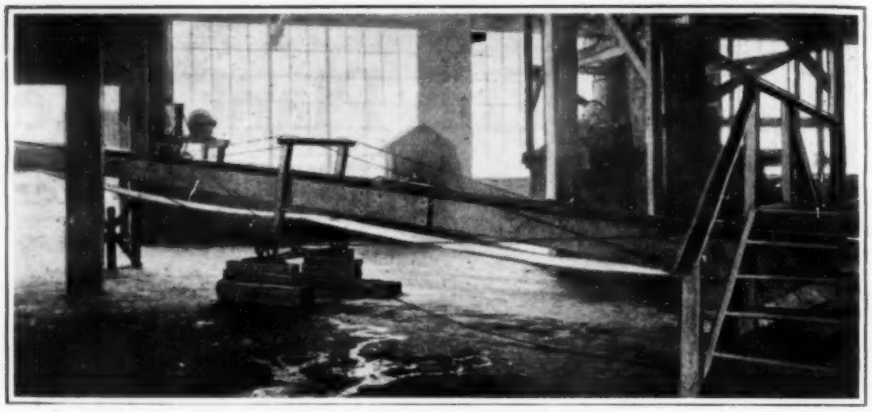
By F. B. Bayless

Metallurgist, Oil Well Supply Co.
Oil City, Pa.

In our malleable foundry we operate a 10-ton air furnace, taking one heat per day. The charging starts at 8:30 a.m. and the heat comes out about 3:00 p.m. The sprue from one day's heat is weighed the following day for use in the next heat. All iron being mixed by analysis, it is necessary to know the composition of each heat early the following morning when making up the charge.

Obtaining drillings from hard iron samples for analysis presented difficulties until we developed the following method: Two test pieces are poured from the first of each heat and two from the last—one of each being used for a fracture test and the other for a chemical analysis. These test pieces are cylinders 1½ inches in diameter by 5½ inches long, poured in open sand molds. They are left in the sand until the heat is out and then those to be used for chemical analysis are thrown into the white hot furnace through the front skimming door. After an all-night anneal, the furnace man removes the charging bungs and takes out the test cylinders.

If these cylinders have been thrown into the furnace promptly they drill readily with an ordinary drill press and give drillings similar to a rather hard gray iron, which are easily dissolved. In this way we are able to return the analyses first thing in the morning.



Portable Conveyor with Overhead Motor Drive

## Portable Conveyor Has Overhead Motor and Magnetic Pulley

A portable conveyor is a useful piece of equipment for emergency work around the plant, for peak storage and for hurried transfer. The unit shown in the accompanying halftone has the motor mounted above the belt, and therefore away from dirt and contamination. The motor pulley is belted to a driven pulley on a lineshaft that passes between the going and returning sections of the conveyor belt and near the head pulley. At the opposite end of this shaft a sprocket and chain drive connects with head pulley, which is of the Ding's magnetic type.

## Preparing Preliminary Data of Investigations

In progressive chemical manufacturing plants that are large enough to require general offices in addition to works offices, there are usually under way investigations of major importance that require monthly reports made from day to day records. These daily records are usually simple quantity and time records easily filled out; but the monthly summaries are often composed mostly of captions followed by percentages, amounts, grades, time periods, etc. These captions take much time to write, even more than the figures.

To relieve the plant superintendent of this time-consuming procedure, well-arranged forms bearing these captions are typed and ruled horizontally and vertically on the typewriter in a sufficient amount to last for some months. This saves much time when the reports are turned in for study, because the figures are all placed where they should be. Also such original records become more valuable for preservation.

In making the forms no special effort is exerted for appearance. The object is to reduce the time that would be required of those with supervisory duties if the reports were made in long hand, to facilitate discussion in conference, to avoid errors from misplaced figures and to speed up the preparation of permanent records from these reports. Such a system applies mostly to temporary procedures, but it has its advantages also as a permanent procedure in some organizations.

## Method for Studying Air Currents

In making ventilation studies, the use of smoke is often a help in determining the flow of air, the direction of currents and the rate of mixing. A special instrument, described in Bureau of Mines Serial 2505, has been found useful for this purpose. It generates sulphur trioxide smoke and is particularly useful in places where fire for generating smoke is not permissible.

The instrument consists of a glass tube containing fuming sulphuric acid on granular pumice stone, fitted at the top with a rubber atomizer. Squeezing the atomizer bulb blows air into the tube. This causes a dense, white smoke to be produced and emitted from the atomizer nozzle. Such a smoke follows and makes visible any currents of air that occur.

## Using Wood Pulp as a Filter Medium

Around pulp mills, wherever occasion arises for using a plate and frame filter, the use of a small amount of wood pulp on the leaves is found to be an aid to obtaining clear filtrates. One plant uses such a filter for taking finely divided impurities such as barium sulphate out of sodium chloride brine. Without the use of some such medium it was found to be extremely difficult to obtain a clear liquor.

The pulp is introduced in the form of a dilute white water solution consisting of ½ lb. of pulp per barrel of water. This is put through the filter ahead of the liquid to be filtered.

For especially difficult filtrations commercial filter mediums are undoubtedly superior to this material. However, where only a small amount of work is to be done or where occasional difficulty is encountered, wood pulp is well worth a trial. For many uses it is likely to prove both cheap and effective.

# Important New Equipment Exhibited at A. G. A. Convention

## Unit Process Devices Shown at Atlantic City Demonstrate Close Tie-Up Between Chemical Engineering and Gas Making

THE 1925 exhibit in connection with the American Gas Association Convention again demonstrated that gas engineering is constantly taking on more and more the characteristics of chemical engineering. Many of the booths presented exactly the same machinery and devices that had been shown to the chemical industries a few weeks before at New York. Of course there were also scores of booths devoted to household gas appliances and to equipment which is distinctively in the field of the gas man; but as in previous years, there were also numerous worth-while exhibits for those in related process industries.

C. W. Hunt Co. exhibited a new type of vibrating screen intended for handling clay and other sticky materials. This they called a "piano-wire vibrating screen," because the screening element consists of a large number of piano wires stretched parallel under 100 lb. tension. In other respects the device was typically a Mitchell electric vibrating screen unit. The size of wire, the spacing, the slope of the screen surface, and other characteristics can be varied to suit the materials handled. Preliminary trials of the first unit at the manufacturers' plant have indicated very great success on materials which are damp or sticky. Further commercial trials are already under way on clay for certain ceramic companies.

The "Roco" screen was exhibited by the Robins Conveying Belt Co. as a new development of the Perfex type. The overhead shaft mounting of this type gives increasing freedom from bearing troubles that result when grit gets into the bearings, which formerly were below the screen level. The newest type of screen shown is several hundred dollars cheaper than one of the same screen area of the older forms, and it appears to have slightly greater capacity. Maximum adjustability is obtained, first by speed variation, second by changing the angle of the screen, and third by changing the location of the lever arm pivots. This last adjustment varies the character of the "kick" which is given the material, proportioning the up and down and the forward and back motion.

Another interesting control instrument was shown by the Cutler-Hammer Co. in its new gas-mixing control. This device, a development of the Thomas meter and Thomas recording calorimeter, is used to control the mixing of gases so that the heating value of the mixture is constant. Five of these devices are already in use and it has been found that the heating value of the mixed gas can be maintained very closely, generally within one per cent of the desired value. This company claims that the same process can be applied on a needle valve for the feeding of a liquid enricher, such as benzol, to maintain the heating value of gas.

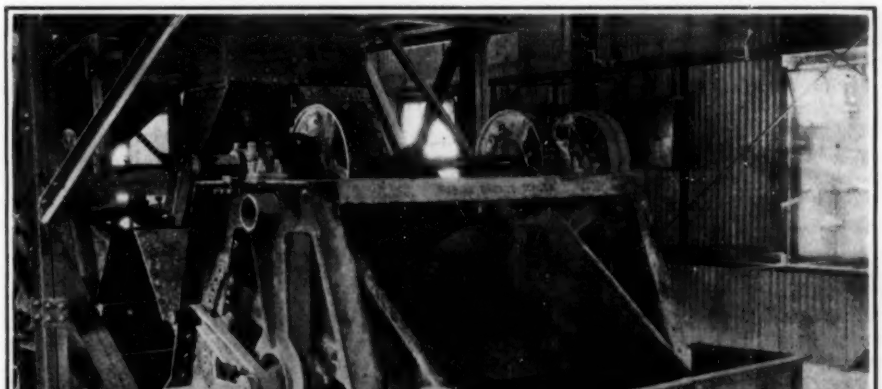
An ingenious means for getting high pressure or superheated steam on a small scale, as for autoclaves, is suggested by the William Kane Manufacturing Co. This concern has on several occasions used their "Las-ten" type of circulating water heater as a superheater. This device has heavy cast-brass heating units which can be subjected to high temperature and pressure without danger. For this purpose they recommend connecting the heater with the top connection as inlet. A trap should be used for drying the steam entering the heater. This device is recommended as safe up to 200 deg. C. and perhaps higher.

The Koppers Co. presented the new apparatus and method which it has developed for removal of naphthalene and gum-forming constituents from gas. This apparatus has been in successful continuous operation at the Seaboard By-Product Coke Co. plant treating 25,000,000 cu.ft. of oven gas per day for a considerable period. Recommendations are made, therefore, on the basis of actual commercial-scale trials. The results cited from the Seaboard plant test show reduction of naphthalene from an initial amount of 16 to 31 grains per 100 cu.ft. down to an average of 3.7 grains in the outlet gas. Gas can be purified to 2 grains napthalene per 100 cu.ft. if desired for distribution under climatic conditions demanding such extreme precaution. Very large advantage in the reduction of meter troubles through removal of gum-forming constituents is anticipated. The lowering of heating value due to the oil-washing method employed is negligible, amounting to barely one-half B.t.u. per cu.ft.

The Waite & Davey Co. exhibited a refractory material providing for air-covering of furnace walls. Their equipment has been installed in numerous steam-boiler furnace plants, in water-gas generators, and in oil-fired equipment.

The Koppers Co. made the first announcement at this exhibit of a new vertical gas oven which it has recently developed. A bench of five of these ovens has been in operation for a short time very successfully at the Seaboard By-Product Coke plant, which is a subsidiary corporation. This new oven is virtually the small Becker-type oven turned on end. It is of approximately the same dimensions as the six-ton Becker oven, being, roughly, 14 in. by 8 ft. in horizontal section and slightly over 20 ft. high inside the oven chamber. The heating system strikingly resembles in flue arrangement the Becker-type oven. The oven may be fired with either oven gas or producer gas. The initial installation is such that the coal capacity at any time is approximately six tons. The time of passage of the coal through the oven is about 12 hours, so that the normal capacity estimated is 12 tons of coal per oven per day. This type of oven is probably slightly more economical to build for small installations than the Becker type. It requires much less ground space and has decided economies in labor requirement for small works. The Koppers Co. does not, however, contemplate using it for plants where more than a very small number of oven units would be required to give the desired capacity.

Two of the most striking developments in water-gas manufacture were presented by the U. G. I. Contracting Co. The first of these, which was discussed in a preliminary way a year ago is the Pier process, which has since found very successful application in a number of plants. The other process, which is new, is a mechanical rotating-grate water-gas generator, analagous to the U. G. I. rotating-grate gas producer. This device was probably the last important development undertaken by the late J. H. Taussig.



**The "Roco" Vibrating Screen**

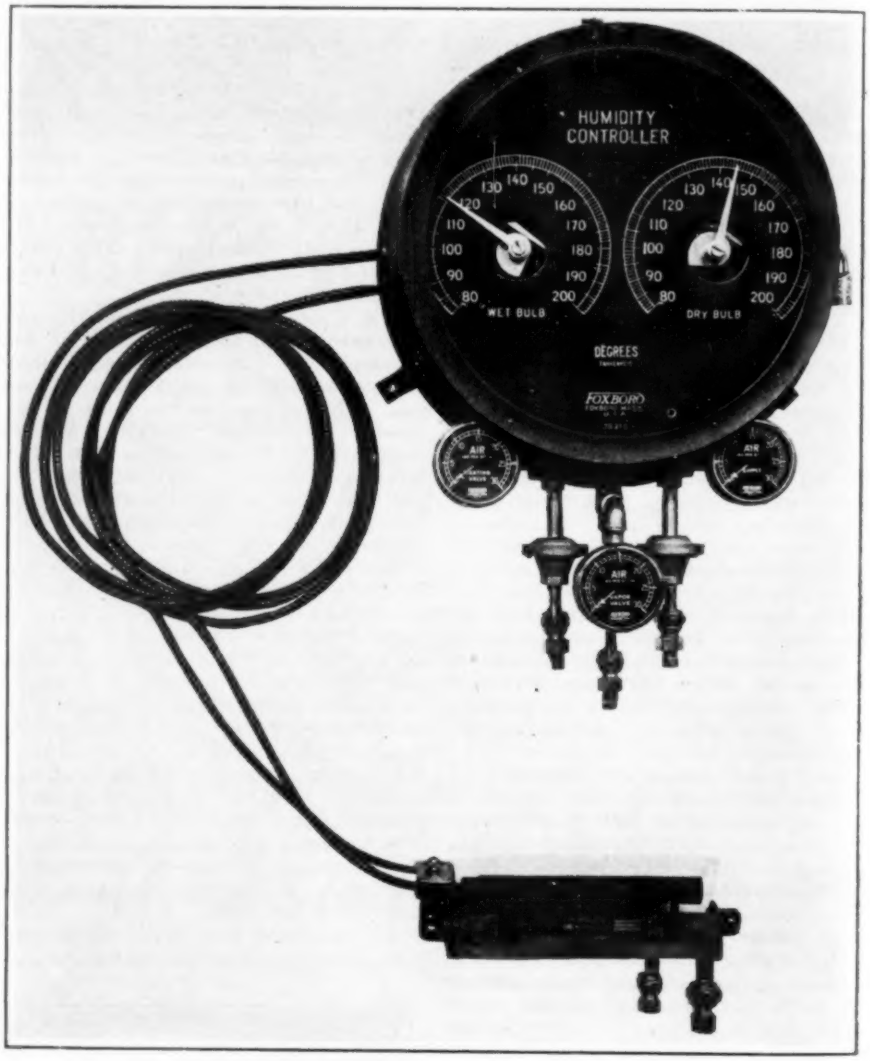
Overhead shaft mounting in this type results in greater freedom from bearing troubles

# Equipment News

*From Maker and User*

## Humidity Controller

A non-recording humidity controller has recently been placed on the market by The Foxboro Co., Foxboro, Mass. This instrument, shown in the accompanying photograph, has separate wet and dry bulb scales, each with individual setting arm and each calibrated for the entire range of the instrument. The temperature elements are replaceable as a unit without disturbing the other parts. The instrument is free from rubber tubing or other parts that might deteriorate. It can be used with any psychrometer, should one be already installed.




Non-Recording Humidity Controller

## Ceramic Material

A new material has recently been placed on the market by the Vitrefrax Co., Los Angeles, Calif., which is said to add greatly to the strength of all types of ceramic ware when it is used as an ingredient. The material is called "Vitrox" and, in addition to its utility in increasing the strength of clay products, it is also said to reduce warping and to control shrinkage.

## Electrical Equipment

Several new developments in electrical equipment of interest to chemical engineers have recently been announced by the General Electric Co., Schenectady, N. Y. Among these, perhaps, the most important is a new totally enclosed motor with control, developed for use in locations where flammable gases are present. This motor has passed the test of the Bureau of Mines and will be approved by that bureau as a permissable motor. It is a d.c. machine and is so far made in but one rating: 5 hp., 900 r.p.m., 550 volts, compound wound. Other ratings will be produced later.

Another new motor, developed primarily for press work, but suitable for other uses is the type BSR. This is an adaptable motor, operating on a.c. current, with a wide speed range and convenient, efficient control. It is of the compensated repulsion type, has high starting torque and changes speed by brush shifting. It operates on single phase, 110 or 220 volt, a.c. circuits and can be operated from any one phase of a 2 phase or 3 phase circuit.

This company has also brought out a new type of drive for centrifugals. This drive, involving the use of a direct coupled, squirrel cage motor, offers the advantage of high starting torque with low power consumption and good performance at full speed. The motor is a special form of the type KTR, a high torque machine with the high resistance portion of the rotor winding built in the form of a fan and located at the top. The heated air developed is thus expelled without passing through the motor proper. Adjustments in acceleration and speed are obtained by operating at the required voltages from an auto transformer serving a number of motors. Two sets of buses are run from the auto transformer, one for accelerating and the other for discharging and top speed operation. The motor is accelerated from the high voltage bus and, when top speed is reached, a current limit relay automatically changes the motor connections to the low voltage bus. This drive combines the advantages of a direct coupled squirrel cage motor with great flexibility in torque and speed characteristics. Power factor and efficiency are said to be high.

## Grinding System

A closed circuit system for the fine grinding of dry materials has recently been developed by the Patterson Foundry & Machine Co., East Liverpool, Ohio. This equipment consists of 2 machines, each dependent on the other. The grinding is accomplished in a short tube mill or ball mill and the separation of sizes of the product of the mill is then done in a centrifugal separator.

In this system only a short length mill is needed, and no attempt is made to accomplish all the desired grinding during the first pass of the material through the mill. In the separator a close separation is accomplished and all the oversize is automatically returned to the mill for regrinding.

This system is said to be advantageous in that the fines are removed

from the mill as fast as they are produced, which does away with any cushioning effect from these fines and results in fast and economical grinding. Capacities are made from 500 lb. per day up to several tons per hour, depending on the material being ground.

## Measuring Machine

A measuring machine for measuring out molding powders such as Bakelite and Condensite, preparatory to placing them in hot molds, has been brought out recently by F. J. Stokes Machine Co., Philadelphia, Pa. In this machine, the powder is measured in a steel die and delivered to containers from which it can be poured into the hot molds. About 40 charges per minute can be measured with high accuracy. The machine will weigh any charge up to 3 ounces in steps of ⅛ to ¼ of an ounce.

## Weighing Conveyed Material

By Earl Stearns
President, Stearns Conveyor Co., Cleveland, Ohio

Many industries must obtain as nearly as possible, the correct weights of the materials entering into their manufacturing processes. A comparatively small variation in proportions used will often result in spoiling a whole batch or a large amount of material.

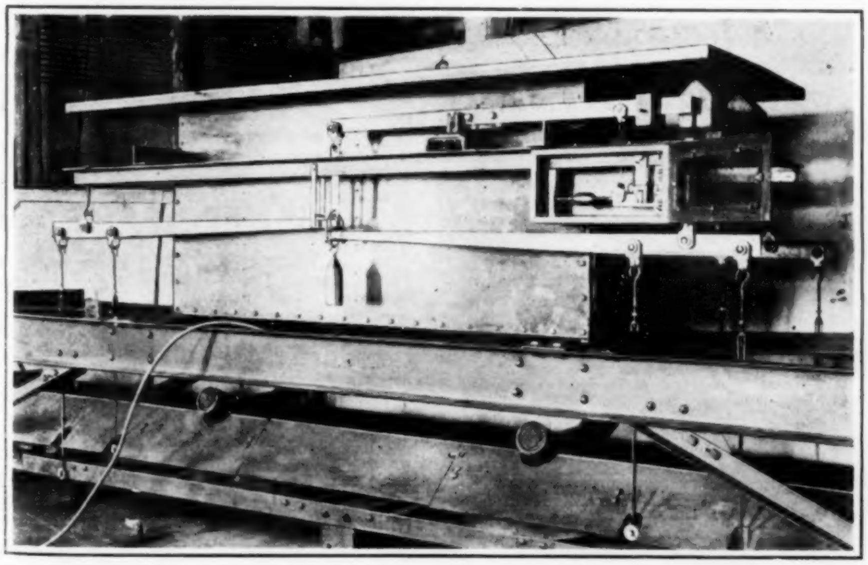
Where conveyors are used for handling the materials, as is most often the case in modern, large-scale plants, this weighing is difficult unless a scale is installed that will weigh the material while on the conveyor. Such a scale should be suitable for installation at a convenient, accessible point on the conveyor and should be as nearly free from the possibility of error and the necessity of readjustment as it can be made. Provision should be made for automatically deducting the tare, that is, the weight of the belt and the errors due to belt tension, for it is almost never possible to maintain a constant feed to the conveyor.

With these points in view, The Stearns Conveyor Co. has recently added the "Messiter" Conveyor Scale to its line. This scale can be used with every form of conveyor in which part of the track can be freely suspended, including, among other types, belt, pivoted bucket, pan and apron conveyors.

The scale is mounted over the conveyor framework at a convenient point and supports a freely suspended portion of the conveyor track or structure, as shown in the accompanying picture. The loaded and return portions of the conveyor are independently carried and balanced against each other on opposite sides of the steel yard arms. This avoids errors due to the tare and results in only the weight of the material that is conveyed being recorded. It is said that error with this scale does not exceed ½ of 1 per cent.

The recording device is electrically actuated, supplied by current from a small generator driven from the foot shaft of the conveyor. The voltage thus varies with the conveyor speed. This current is modified by the action of a mercury dashpot and plunger. The plunger is actuated directly by the movements of the scale-beams, and varies the level of the mercury in the dashpot, thus changing the resistance in exact proportion to the instantaneous load. The product of the voltage and the current of the generator is thus directly proportional to the conveyor speed and the instantaneous weight. This product is recorded by an integrating wattmeter calibrated to read in any convenient unit instead of in kw.-hr.

The recorders (or indicating dials, if these are desired) may be placed in any position, for instance, in the office. With this remote recording is also the possibility of a further modification by means of which the output of the conveyors may be automatically controlled. By means of relay-operated switches connected in the driving motor circuits, the conveyor speeds may be varied with varying feeds so as to deliver exact and uniform quantities per minute, or may be set to deliver a certain definite quantity and then stop until restarted for the next batch. The setting of the compensating weights that adjust for deductions due to varying belt-tension and tare is easily accomplished. Once set, there is no need for further adjustment unless some change is made in the conveyor.



"Messiter" Scale for Weighing Material Passing on Conveyor

Spherical Gas Holder

## Spherical Gas Holder

The accompanying picture shows a "Hortonsphere" built for use as a city gas holder by the Chicago Bridge & Iron Co., Chicago, Ill. This design of tank was originally developed for the storage of casinghead gasoline. It has recently been adopted as a gas holder by some companies and the tank shown is a 300,000 cu.ft. holder of 57½ ft. diameter erected for the Central Arizona Power & Light Co., Phoenix, Ariz.

## Viscosimeter

An electrically heated, stirred and controlled Saybolt viscosimeter has recently been added by the C. J. Tagliabue Mfg. Co., 18—33rd St., Brooklyn, N. Y., to its line of oil testing instruments. The temperature control consists of a temperature sensitive brass bulb, connected by flexible tubing with an expansion coil carrying the moving thermostatic contact. The other contact is a silver disc which is intermittently turned by the action of the relay arm, thus preventing sticking contacts.

Current for controlling the temperature of the bath passes through the tungsten contacts of the relay, which is operated by the current passing through the thermostatic contacts. Voltage for this thermostatic circuit is secured from the line by tapping off a slide wire rheostat. This method is also used to secure the proper voltage for the controlling heating currents.

Two electric heaters are used, one of 125 w. capacity, the other 500 w. For quick heating, the 500 w. heater is used direct. The automatic control provided gives a highly sensitive control, to $\frac{1}{10}$ degree at 100 deg. F. and $\frac{1}{10}$ degree at 210 deg. F., while at the same

time a very small current passes through the relay contacts. The temperature setting can be changed by means of a thumbscrew. The sliding contact on the rheostat can be used to vary the amount of current to the uncontrolled heater. It also can be adjusted to take care of extremes of atmospheric temperature.

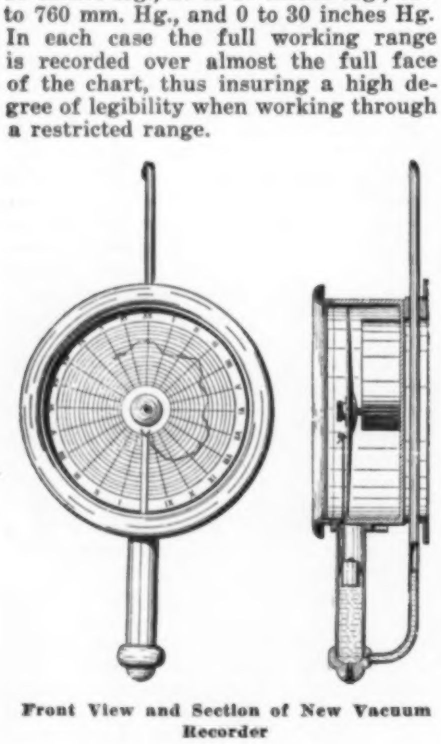
Uniform temperature of the bath is secured by a stirring device. Since the bi-metallic type of thermostat is not employed, either water or oil can be used in this bath which is advantageous, as the A.S.T.M. has specified water as the standard bath liquid.

## Motor Switch

A motor-circuit switch which permits easy disconnecting of both motor and control from the line under practically all conditions except a dead short circuit, has recently been placed on the market by the General Electric Co., Schenectady, N. Y. It consists of contact elements mounted on insulated shafts and connected through a snap-action mechanism to the operating handle on the outside of a sheet-steel enclosing case. Case and handle can both be locked in the open position so that unauthorized persons cannot close the switch.

## Vacuum Recorder

A new line of vacuum recorders is now being made by Uehling Instrument Co., Paterson, N. J. These gages, of which the front view and longitudinal section are shown in the accompanying sketch, operate by means of a mercury column and employ no other moving parts than the pen. This is said to insure permanent accuracy. These recorders are available for the following ranges: 25 to 30 inches Hg., 20 to 30 inches Hg., 27 to 30 inches Hg., 630 to 760 mm. Hg., and 0 to 30 inches Hg. In each case the full working range is recorded over almost the full face of the chart, thus insuring a high degree of legibility when working through a restricted range.



**Front View and Section of New Vacuum Recorder**

## Cast Steel Chain

The Stephens-Adamson Mfg. Co., Aurora, Ill., is now offering chains for conveyors, elevators and power transmission made from "Farrell's 85, Special Purpose Cast Steel." This is a new cast steel of high tensile strength and resistance to wear, said to be comparable to alloy steel but less expensive.

## Manufacturers' Latest Publications

General Electric Co., Schenectady, N. Y.—Catalog GEA-77—A catalog of capacitors for power factor correction.

Robinson Mfg. Co., Muncy, Pa.—A folder describing crushers, grinders, sifters, pulverizers, reels, mixers and conveyors for chemical and kindred industries.

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.—Bulletin No. 77-N.—A catalog of portable air compressors for all purposes.

Brown Instrument Co., Philadelphia, Pa. —Catalogs Nos. 44 and 74—The first of these describes electric tachometers and the second describes recording pressure and vacuum gages.

Russell Engineering Co., St. Louis, Mo.—A folder on tunnel kilns for burning firebrick and refractory shapes.

Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.—Catalog No. 93—Catalog of the "Homo" method for the drawing of steel.

Crescent Truck Co., Lebanon, Pa.—New general catalog of electric industrial trucks and tractors of all types.

The Foxboro Co., Inc., Foxboro, Mass.—Catalog of indicating thermometers of the dial type for all industrial purposes.

Heisler Locomotive Works, Erie, Pa.—Catalog of geared steam locomotives for industrial haulage.

F. J. Stokes Machine Co., Philadelphia, Pa.—Catalog No. 26—Catalog of vacuum dryers, chemical apparatus, impregnators and similar equipment.

Schutte & Koerting Co., Philadelphia, Pa. —Bulletin 9M—A pamphlet describing magnetic oil strainers for lubricating oil.

Flexible Steel Lacing Co., Chicago, Ill.—Folder DH—Folder describing "Flexco" belt fasteners.

The Thermal Syndicate, Ltd., 58 Schenectady Ave., Brooklyn, N. Y.—New catalog and price list of "Vitreosil" ware for the laboratory.

Homestead Valve & Mfg. Co., Homestead, Pa. — Folder describing the Homestead "Protected Seat" hydraulic operating valve.

Goheen Corporation, Newark, N. J.—Two new folders on "Galvanum," a paint especially prepared for covering the surface of galvanized iron.

Harold E. Trent, 259 N. Lawrence St., Philadelphia, Pa. — Two leaflets, one on thermometer test tanks and the other on electric soldering irons.

Sullivan Machinery Co., Chicago, Ill.—Catalog No. 80—Catalog of diamond core drills giving full information on drills and auxiliary equipment, the cost of drilling, prospecting and other topics of interest to drill users.

Foote Bros. Gear & Machine Co., Chicago, Ill.—Catalog No. 26—Complete catalog of "IXL" speed reducers with specifications, dimensions, information on couplings and methods for selection of reducers.

Schutte & Koerting Co., Philadelphia, Pa. —Two new bulletins, the first being a catalog of all appliances made by this company for use in the petroleum industry; and the second a bulletin on steam jet thermo-compressors, a device for mixing live steam with exhaust steam in order to produce low pressure steam.

Thyle Machinery Co., San Francisco, Calif.—Bulletin entitled "Automatic Control of Underflow," describing the construction and application of the "Bradley" valve for the automatic control of the underflow of thickness, settlers and similar apparatus.

American Smelting & Refining Co., Selby Smelting Works, San Francisco, Calif.—Catalog 25—A guide for buyers and users of lead, of products made partly of lead and of alloyed metals.

D. O. James Mfg. Co., Chicago, Ill. —Catalog No. 99—New general catalog of gears, speed reducers, couplings, and power transmission machinery together with many engineering data.

Stuart & Peterson Co., Burlington, N. J. —Bulletin describing the "Red Crown" electric glue pot.

Alexander Milburn Co., Baltimore, Md.—Bulletin No. 200 A—Bulletin describing standard types of regulators for reducing gas pressures for welding, cutting and other operations.

Edwin L. Wiegand Co., Pittsburgh, Pa.—Bulletin C-100—Booklet describing "Chromalox" electric heating units of various types for industrial heating purposes.

Sweet & Doyle Fdy. & M. Co., Troy, N. Y. —Bulletin No. 8—A folder describing a condensation eliminator for steam lines.

Crouse-Hinds Co., Syracuse, N. Y.—A folder and a booklet on safety hand lamps and hand lanterns of the electrical type.

Wagner Electric Corp., St. Louis, Mo.—A booklet entitled "Fifty Questions and Answers on Power Factor."

Chas. Cory & Son, Inc., 183 Varick St., New York, N. Y.—Bulletin No. 104-29-B, Part 2—A bulletin describing audible and visible signals featuring turbine order systems.

Scientific Materials Co., Pittsburgh, Pa.—Bulletin No. 111—A catalog describing 4 new laboratory gas burners.

Crawford Co., 3220 West 31st St., Chicago, Ill. — Two folders describing pipe hangers and brackets.

Denver Fire Clay Co., Denver, Colo.—A folder on crucibles, scorifiers and muffles for assaying work.

Jonathan Bartley Crucible Co., Trenton, N. J.—A booklet giving the results of a Nielsen survey on the use of "Lawtonite" refractories as furnace linings.

Brown Instrument Co., Philadelphia, Pa. —Catalog No. 87—A catalog of indicating, recording, signaling and alarm instruments for the automatic control of temperatures.

Brown Instrument Co., Philadelphia, Pa. —A booklet announcing a new line of recording pyrometers.

International Nickel Co., 67 Wall St., New York, N. Y.—A bulletin showing the use of Monel metal in many types of chemical engineering equipment, reprinted from *Chem. & Met.* for August, 1925.

Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—Folder describing a new multiple draft indicator in which the draft of any number of units up to 12 is shown by the same instrument.

Firth-Sterling Steel Co., McKeesport, Pa. —A catalog of tool steels giving descriptions of various grades of tool steel, specifications and other data and featuring a system of "Simplified Shop Tooling."

Chicago Steel & Wire Co., 103d St. and Torrence Ave., Chicago, Ill.—A booklet on the properties of steel filler rods for gas and electric welding.

The Austin Co., Cleveland, Ohio.—Catalog No. 20.—The eighth edition of "The Austin Book of Buildings" a book describing the Austin method of erecting industrial buildings, copiously illustrated with examples of existing plants.

Celite Products Co., Los Angeles, Calif.—Booklet No. 208—A booklet entitled "Filter-Aids," describing the use of Filter-Cel, Standard Super-Cel, and Hyflo Super-Cel as filtering mediums with pressure filters in handling sugars, syrups, chemicals, dyes, varnishes, oils, fruit juices, food products, etc.

Esterline-Angus Co., Indianapolis, Ind.—A folder showing a full size sample of a daily record chart from the "Twin Type" meter.

Celite Products Co., Los Angeles, Calif.—Bulletin No. 114—A bulletin describing heat insulation of glass manufacturing equipment with Sil-O-Cel products.

New Departure Mfg. Co., Bristol, Conn. —Bulletin No. 169 F.E.—Bulletin covering a planetary, ball-bearing, speed reduction unit. Also sheet VII FE, a general description of ball bearings made by this company.

Industrial Separators Co., Inc., 233 Broadway, New York, N. Y. — A bulletin describing the "Industrial" continuous filter and its various applications, also its combined operation with the Genter thickener.

Mogul Machine Co., Witherspoon Bldg., Philadelphia, Pa. — Bulletin EXJ-1 — A bulletin describing the "Double-End-Guided" expansion joint for pipe lines.

Bailey Meter Co., Cleveland, Ohio — Bulletin No. 34—A new catalog entitled "Fluid Meters for Steam and Water," describing flow meters for various purposes.

Edge Moor Iron Co., Edge Moor, Del.—A catalog describing the Edge Moor single pass boiler, a boiler made up of a heating section proportioned to bring the water gradually to the boiling point, a closed circuit steaming section and a superheater.

Midwest Air Filters, Inc., 100 E. 45th St., New York, N. Y.—Folders No. 400, 401 and 402—Three folders describing, respectively, systems for supplying clean air in industrial plants, in building ventilation and for electrical equipment.

# Patents Issued Oct. 6 to Nov. 3, 1925

### Paper, Pulp and Sugar

Treatment of Raw Material in the Manufacture of Chemical Wood Pulp. George A. Richter, Berlin, N. H., assignor to Brown Company Berlin, N. H.—1,557,880.

Pulp Process. Joseph H. Wallace, Stamford, Conn., assignor to Pine Waste Products, Inc., New York, N. Y.—1,560,446.

Pulp Grinder. Donald W. Eipper, Turners Falls, Mass.—1,560,151.

Manufacture of Cellulose. Antoine Regnouf de Vains, Miribel, France.—1,556,497.

Paper-Drying Machine. Harold F. Dunbar, Turners Falls, Mass.—1,556,918.

Paper Drier. Charles W. Shartle, Middletown, Ohio, assignor to The Shartle Brothers Machine Company, Middletown, Ohio.—1,559,188.

Paper-Sizing Process. Judson A. De Cew, New York, N. Y., assignor to Process Engineers, Inc., New York, N. Y.—1,558,846.

Method of Producing Half Stuffs and Cellulose. Roland Runkel, Rottenburg-on-the-Neckar, Germany.—1,557,338.

Treatment of Cellulosic Fibers and Fabrics. Frank Leslie Barrett, Whalley Range, near Manchester, and Robinson Percy Foulds, Colne, near Manchester, England, assignors to Tootal Broadhurst Lee Company Limited, Manchester, Lancaster, England.—1,558,453.

Process of Separating Sugar From Residual Molasses. Christofer G. Leonis, Salt Lake City, Utah.—1,558,554.

Manufacture of Grape Sugar. Adolph W. H. Lenders and John M. Widmer, Cedar Rapids, Iowa, assignors to Penick & Ford Ltd. Incorporated, Cedar Rapids, Iowa.—1,556,854.

### Rubber and Synthetic Plastics

Rubber Vulcanization and Product Thereof. Stuart B. Molony, Wellesley Hills, Mass., assignor, by mesne assignments, to R. T. Vanderbilt Co., Inc., New York, N. Y.—1,558,707.

Vulcanizing Process. Ernest Hopkinson, New York, N. Y.—1,559,702.

Vulcanizing Rubber. George H. Stevens, Newark, N. J.—1,559,196.

Process for Treating Rubber and Similar Materials and to the Products Obtained Thereby. Theodore Whittelsey, Upper Montclair, and Charles E. Bradley, Montclair, N. J., assignors to The Naugatuck Chemical Company.—1,559,393.

Method of Treating Rubber. Clarence M. Carson, Akron, Ohio., assignor to The Goodyear Tire and Rubber Company, Akron, Ohio.—1,560,465.

Method of Treating Rubber. Ellwood B. Spear, Akron, Ohio, assignor to The Goodyear Tire & Rubber Company, Akron, Ohio. —1,560,488.

Process of Compounding Rubber. Chauncey C. Loomis, Yonkers, and Horace E. Stump, Brooklyn, N. Y., assignors, by mesne assignments, to The Hevea Corporation.—1,558,688.

Process for Retarding the Deterioration of Rubber and Similar Materials and Products Obtained Thereby. Sidney M. Cadwell, Leonia, N. J., assignor to The Naugatuck Chemical Company, Naugatuck, Conn.—1,556,415.

Rubber Compound and Its Process of Manufacture. Erwin E. A. G. Meyer, Detroit, Mich., assignor to Morgan & Wright, Detroit, Mich.—1,558,701.

Process of Making Rubber Compositions. George Wilson Acheson, Newark, N. J.—1,560,132.

Process and Apparatus for Treating Reclaimed Rubber. Harry Hunter, deceased, late of Indianapolis, Ind., by Paul R. McCampbell, administrator, Indianapolis, Ind., and Oren M. Ragsdale, Indianapolis, Ind., assignors, by mesne assignments, to Carrier Engineering Corporation, Newark, N. J.—1,558,546.

Process and Apparatus for Masticating Rubber. Harry Clarance Young, Sutton, and Colin Macbeth, Four Oaks, England, assignors to Dunlop Tire and Rubber Corporation of America, Buffalo, N. Y.—1,556,141.

Sprayer. Joseph G. Coffin, Hempstead, N. Y., assignor to General Rubber Company, New York, N. Y.—1,558,593.

Plastic Composition and Method of Using It. Carl T. Fuller, Nutley, N. J., assignor to General Electric Company.—1,560,346.

Cyclohexanol-Aldehyde Resin and Process of Making the Same. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company.—1,557,521.

Keto-Alcohol Resin and Process of Making the Same. Carleton Ellis, Montclair, N. J.—1,557,571.

Production of Resin. Frank E. Greenwood, New Rochelle, N. Y., assignor to Pine Waste Products, Inc., New York, N. Y.—1,560,420.

### Petroleum Refining

Method of Distilling Oil. Leon E. Hirt, Los Angeles, Calif.—1,559,701.

Process of Continuous Rectification of Spirits, Petroleums, and Benzols. Emile Augustin Barbet, Paris, France.—1,559,218.

Recovery of Gasoline, Etc. Harold B. Bernard, Tulsa, Okla., assignor to Sinclair Oil and Gas Company, Tulsa, Okla.—1,560,137.

Apparatus for Treatment of Hydrocarbon-Oil Vapors. Frederick Lamplough, Highfield, Feltham, England, assignor to F. Lamplough & Company, Limited, London, England.—1,557,478.

Process for Treating Petroleum Emulsions. William S. Barnickel, St. Louis, Mo.; Sears Lehmann and John S. Lehmann executors of the said William S. Barnickel, deceased.—1,558,818.

Emulsion and Process of Making Same. Jacque C. Morrell, Oak Park, Ill.—1,556,005.

Process and Apparatus for Dehydrating Emulsified Oils. Gustav Egloff and Harry P. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill. —1,559,035

Medium for Bleaching, Cracking, and Desulphurizing Petroleum and Other Hydrocarbon Compounds and Process of Preparing Same. Herman Reinbold and Hugo Reinbold, Omaha, Nebra.; said Hugo Reinbold assignor to said Herman Reinbold.—1,558,631.

Process for Condensing Vapors. Edward W. Isom, Locust Valley, and John E. Bell, Brooklyn, N. Y., assignors to Sinclair Refining Company, Chicago, Ill.—1,558,811.

Recovering Oils. Victor S. Allien, Wilmington, Del., assignor to Darco Corporation, Wilmington, Del.—1,556,396.

Method and Apparatus for Avoiding Shock Chill in Precipitating Substances from Liquids. Leo D. Jones, Philadelphia, Pa., assignor to The Sharples Specialty Company, Philadelphia, Pa.—1,558,619.

Process of Producing Wax-Free Products from Crude Petroleum. Earl Petty, Winfield, Kans., assignor to The De Laval Separator Company, New York, N. Y.—1,559,982.

Method of and Tank for Storing Oil. Smith L. Stovall, Kerto, Calif., assignor to C. A. Gibson and J. F. Gibson, Jr., both of Visalia, Calif.—1,559,016.

### Carbonization and Combustion

Fuel-Pulverizing Apparatus. John E. Bell, Brooklyn, N. Y., and Henry Kreisinger, Pittsburgh, Pa., assignors to Combustioh Engineering Corporation.—1,558,663.

Pulverizing System. Virginius Z. Caracristi, Bronxville, N. Y., assignor to Locomotive Pulverized Fuel Company.—1,559,-220.

Pulverizing Apparatus. George P. Jackson, Flushing, N. Y., assignor to Combustion Engineering Corporation, New York, N. Y.—1,559,170.

Coking-Retort Oven. Joseph Becker, Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,556,749.

Carbonizing or Distillation Apparatus. Nat Harris Freeman, Holborn, London, England.—1,558,974.

Retort Apparatus for the Treatment of Materials such as Shale, Coal, and the Like. William Guy-Pell, London, England. —1,558,671.

Continuous Distillation Oven. Julien Pieters, Paris, France.—1,560,311.

Annular Kiln for Drying as well as for Carbonizing Solid Carbonaceous or the Like Materials. Otto Dobbelstein, Essen, and Hermann Hess, Duisburg, Germany. —1,556,571.

Destructive Distillation of Wood. Duncan P. Shaw, Fayetteville, N. C.—1,559,994.

Apparatus for Wood Distillation. John L. Weaver, New Orleans, La.—1,560,517.

Continuous Method and Apparatus for Calcining and Clinkering. Robert D. Pike, San Francisco, Calif.—1,557,873.

Plant for Gasifying Fuel. Arthur McDougall Duckham, London, England. —1,560,337.

Method and Means for the Manufacture of Illuminating Gas. Linford S. Stiles, Brooklyn, N. Y.—1,558,124.

Method and Apparatus for Conserving Heat from Industrial Furnaces. Peter Kucera, Connellsville, Pa., assignor to Capstan Glass Company, Connellsville, Pa. —1,560,063.

Furnace for Granular Fuel Such As Brown Coal Coke. Clemens Düllmann, Liebertwolkwitz, near Leipzig, Germany, assignor to Deutsche Patent Grudeofen-Fabrik Walter Rieschel & Co., m. b. H., Liebertwolkwitz, near Leipzig, Germany.—1,559,744.

Furnace-Fire-Arch Construction. Robert H. Kuss, Chicago, Ill., assignor to K-R Furnace Company.—1,558,819.

Construction and Operation of Tunnel Kilns. Robert W. Steere, Providence, R. I., assignor to American Dressler Tunnel Kilns, Inc., New York, N. Y.—1,556,260.

Coke-Cooling Aparatus. Arnold Moettell, Oberwinterthur, Switzerland.—1,557,077.

Dehydrated Lignite. Eugene P. Schoch, Austin, Tex.—1,556,036.

Fuel Briquette and Process of Making the Same. John F. O'Donnell, Morris Run, Pa.—1,557,320.

Treatment of Finely-Divided Coal. William Warwick Stenning and Walter Henry Beasley, London, England, assignors to Minerals Separation North American Corporation, New York, N. Y.—1,560,116.

### Dyes and Organic Processes

New Ortho-Hydroxyazo Dye. Oskar Kaltwasser, Berlin, Hermann Kirchoff, Berlin-Lichterfelde, and Hans Oehrn, Charlottenburg, Germany, assignors to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany.—1,556,329.

Process for the production of New Azo Dyestuffs Insoluble in Water. Georg Kalischer, Mainkur, near Frankfort-on-the-Main, and Karl Keller, Frankfort-on-the-Main, Germany, assignors to Leopold Cassella & Co., Gesellschaft mit beschränkter Haftung.—1,558,890.

Disazo Dye. Richard C. Miller, Winfield, Long Island, N. Y., assignor of one-half to Toch Brothers, Incorporated, New York, N. Y.—1,557,265.

Vat Dyestuff and Process of Making Same. Joseph G. Dinwiddie, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,558,252.

Process of Treating Cellulose Acetate. Edward S. Farrow, Jr., Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,557,147.

Process for Producing Alkali-Metal Xanthates, Russell B. Crowell, Agnew, and Gerald F. Breckenridge, San Jose, Calif., assignors to Western Industries Company, Agnew, Calif.—1,559,504.

Noninflammable Nitrocellulose Composition. William Morgan Johnson, Newark, N. J.—1,554,505.

Purification of Viscose Solutions. Walter James Stevenson, deceased, late of London, England, by May Lucie Stevenson, administratrix, Pinner, England, assignor to Artsilk Limited, London, England.—1,556,174.

Tanning Composition. Carl Immerheiser, Ludwigshafen-on-the-Rhine, and Hugo Wolff, Mannheim, Germany, assignors, by mesne assignments, to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Bavaria, Germany.—1,557,844.

Leather-Tanning Compound. George W. Langley and Argus A. Howell, Greenbrier, Ark.; said Howell assignor of his entire right to Dan N. Ward, Greenbrier, Ark.—1,557,174.

Decolorizing Carbon and Process of Producing the Same. Herbert M. Shilstone, New Orleans, La.—1,556,039.

Method of Manufacture of Prepared Charcoal. Arthur Wesley Smith, Baltimore, Md., assignor of one-half of William W. Varney, Baltimore, Md.—1,559,054.

Compound of Cinchona Alkaloids and 2-Phenyl-Quinoline-4-Carboxlic Acid. Harley W. Rhodehamel, Indianapolis, Ind., assignor to Eli Lilly & Company, Indianapolis, Ind.—1,553,266.

Condensation Product Containing Sulphur. Paul Virck, Dessau in Anhalt, Germany, assignor to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany.—1,553,014.

Process of Making Casein. Adolph Messmer, San Francisco, Calif.—1,557,181.

Comminuted Organic Peroxide and Process of Obtaining Same. Thilo Kroeber, Westend, near Berlin, Germany, assignor, by mesne assignments, to N. V. Internationale Oxygenium Maatschappij "Novadel," Deventer, Netherlands.—1,555,805.

Process and Apparatus for the Continuous Chlorination of Cellulosic Materials by Means of Chlorine Water. Antoine Regnouf de Vains, Miribel, France.—1,556,498.

Method of Treating Wood-Tar Oil. Augustus E. Maze, East Orange, N. J., assignor to Ellis-Foster Company, Montclair, N. J.—1,558,446.

Dextrose Hydrate. William B. Newkirk, Riverside, Ill., assignor to International Patents Development Company, Wilmington, Del.—1,559,176.

Manufacture of Nitrogenic and Phosphatic Combinations. Joseph Breslauer, Geneva, Switzerland, and Georges Darier, Bordighera, Italy, assignors to Société d'Etudes Chimiques pour l'Industrie, Geneva, Switzerland.—1,559,516.

Propellant Powder. John B. Fidlar, Brooklyn, N. Y., and Charles R. Franklin, Dover, N. J.—1,552 601.

Explosive and Process of Making Same. Robert C. Moran, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,560,427.

Solvent and Vehicle for Resinous and Gelatinized Material. Carl D. Hocker, East Orange, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y.—1,558,880.

Furfural Product and Process of Making Same. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Company. —1,558,442.

Manufacture of Benzoyl Chloride. Anthony George, Niagara Falls, N. Y., assignor to The Mathieson Alkali Works, Inc., New York, N. Y.—1,557,154.

Calcium Salt of the Organic Phosphorus Compound Contained in Milk Casein and Process of Making the Same. Swigel Posternak, Chene-Bougeries, near Geneva, Switzerland, assignor to The Society of Chemical Industry in Basle, Basel, Switzerland.—1,555,517.

Mixed Esters of Lower and Higher Fatty Acids and Process of Making Same. George L. Schwartz, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,558,299.

Purification of Butyric Aldehyde. Charles Bogin, Terre Haute, Ind., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,556,067.

Process of Making Tetra-Alkyl Lead. William S. Calcott, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,559,405.

Process of Making Isobornyl Esters. Joseph Ebert, Hillside, N. J., assignor of one-third to John C. Dehls, Newark, N. J., and one-third to Leo Stein, East Orange, N. J.—1,555,947.

Production of Oxygenated Organic Compounds. Alwin Mittasch, Ludwigshafen-on-the-Rhine, Mathias Pier, Heidelberg, and Karl Winkler, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,558,559.

Process of Manufacture of Cyanides and Their Derivatives from the Alkali-Earth-Metal Cyanamides. Paul Comment and Daniel Hatt, Thann, France, assignors to Fabriques de Produits Chimiques de Thann et de Mulhouse, Thann, Haut-Rhin, France. —1,555,944.

Method for the Manufacture of Diphenylamine Chlorarsine. Wellington Lee Tanner, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,557,384.

Oxidizing Organic Bodies. Joseph V. Meigs, Montclair, N. J., assignor, by mesne assignments, to Ellis-Foster Company, a Corporation of New Jersey.—1,560,297.

Manufacture of Urea from Ammonium Carbamate. Norman W. Krase, Clarendon, Va., and Vernie Lesessne Gaddy, Dillon, S. C., assignors to Richard C. Tolman, trustee.—1,558,185.

## Inorganic Processes

Aluminum Chloride Process. Henry I. Lea, Santa Monica, and Clifford W. Humphrey, Burlingame, Calif.—1,558,897.

Method of Combining Soda Ash and Water. Joseph A. Bradburn, Syracuse, N. Y., assignor to National Chemical Company, Syracuse, N. Y.—1,557,974.

Process of Making a Calcium Preparation. Heinrich Umber, Berlin, Germany, assignor to Johann A. von Wülfing, Berlin, Germany.—1,559,478.

Process of Producing and Seasoning Hydrated Lime. David R. Bone, Oglesby, Tex.—1,556,670.

Method of Making Anhydrous Magnesium Chlorides. Paul Cottringer and William R. Collins, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.—1,557,660.

Process of Making Alkali-Metal Carbonate. George Nelson Libby, Redwood City, Calif., assignor to National Magnesia Manufacturing Company, San Francisco, Calif.—1,558,901.

Method of Manufacturing Sulphuric Acid. Jean V. Skoglund, New York, N. Y.—1,559,292.

Process for the Use of Mixtures of Aluminous Cements with Ordinary Cements. Speranza Séailles, née Calogéropoulos, and Jean Séailles, Paris, France, assignors to Société Anonynme "L A P," Paris, France.—1,556,038.

Revivifying Fuller's Earth. Frank W. Hall, Port Arthur, Tex., assignor to The Texas Company, New York, N. Y.—1,558,162.

Free - Burning Sulphur. James W. Schwab, Gulf, Tex., assignor to Texas Gulf Sulphur Company, Bay City, Tex. —1,556,037.

Method of Producing Oxides of Nitrogen. Henrik Gustav Allan Ramsay, Linkoping, Sweden, assignor to Stockholms Superfosfat Fabriks Aktiebolag.—1,558,046.

Process of Fixing Nitrogen. John Collins Clancy, New York, N. Y.—1,556,202.

Oxidation of Ammonia. Carleton Ellis, Montclair, N. J., assignor to Ellis Foster Company.—1,558,598.

Insecticide. Gilbert E. Seil and Oscar F. Hedenburg, Pittsburgh, Pa., assignors to Frank O. Moburg, Toledo, Ohio, and The Roessler & Hasslacher Chemical Company.—1,559,961.

Insecticide. Ruric C. Roark, Baltimore, Md.—1,553,112.

Process for Separating Calcined Colemanite from Clay and Other Impurities. Henry D. Hellmers, Las Vegas, Nev., assignor to West End Chemical Company, Oakland, Calif.—1,556,110.

Process of Making Hydrated Alumina and By-Products. Glen Lenardo Williams, Detroit, Mich.—1,559,489.

Production of Alkali-Silicate Solution. Laurence William Codd, Northwich, England.—1,557,491.

Manufacturing Red Lead. Henry Hocking, Budapest, Hungary, assignor of one-half to Orion Rezkoho-es Rézgálicgyár Részvenytársaság, Budapest, Hungary.—1,556,820.

Manufacture of Titanium Sulphate. Herbert N. McCoy, Chicago, Ill., assignor to Lindsay Light Company, Chicago, Ill. —1,559,113.

Pigment and Process for Making the Same. Samuel F. Walton, Cambridge, Mass., assignor to Kalmus Comstock & Westcott, Inc., Boston, Mass.—1,552,973.

## Electrolytic Cells and Processes

Battery Cell. Earl A. Harris, Scranton, Pa.—1,556,932.

Electric Battery. Paul E. Norris, Wilkinsburg, Pa., assignor to Westinghouse Union Battery Company, Swissvale, Pa. —1,558,910.

Primary Battery. Leopold Darimont, Brussels, Belgium.—1,560,379.

Process of Making Dry Batteries. Boris H. Teitelbaum, Brooklyn, N. Y., assignor to Bright Star Battery Co., New York, N. Y. —1,558,413.

Electrolytic Cell. Isaac H. Levin, New York, N. Y., assignor, by mesne assignments, to Gas Industries Company, Pittsburgh, Pa.—1,560,250.

Battery. William L. Whidden and Lorenzo McCartney, Morgan Hill, Calif. —1,557,952.

Storage Battery. Thomas A. Edison, West Orange, N. J.—1,559,562.

Electric Storage Battery. John Ferreol Monnot, Mill Hill, England.—1,557,602.

Lead Electrode for Accumulators. Albert Strasser, Rorschach, Switzerland. —1,559,471.

Electrodeposition Process. Aloysius J. Cawley, Pittston, Pa.—1,557,980.

Electrolytic Condenser. Charles Le G. Fortescue, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company.—1,558,859.

Criculation Electrolyzer for Alkaline Chlorides. Francesco Giordani and Umberto Pomilio, Naples, Italy.—1,558,085.

Electrodepositing Method and Apparatus. William W. McCord, Wyandotte, Mich., assignor to McCord Radiator & Mfg. Co., Detroit, Mich.—1,555,866.

Method and Apparatus for Continuously Coating Roofing Elements Electrolytically. Julius H. Gillis, Elizabeth, N. J., assignor, by mesne assignments, to Anaconda Sales Company.—1,559,041.

Method and Anode for Electro-Deposition of Rust-Resisting Coatings. Christian John Wernlund, Tottenville, N. Y., assignor to The Roessler & Hasslacher Chemical Company, New York, N. Y.—1,556,271.

## Chemical Equipment and Processes

Crusher. Edward H. Frickey, St. Louis, Mo.—1,560,049.

Crusher. Benjamin A. Mitchell, Westerleigh, N. Y.—1,556,797.

Attrition Mill. Allan P. Daniel, Springfield, Ohio, assignor to The Bauer Brothers Company, Springfield, Ohio.—1,556,764.

Crusher. Benjamin A. Mitchell, New York, N. Y.—1,557,307.

Grinder and Shredder. Harry J. Shelton, St. Louis, Mo.—1,557,888.

Pulverizing Machine. Ernst H. Elzemeyer, St. Louis, Mo., assignor to American Pulverizer Company, St. Louis, Mo. —1,557,444.

Drying Apparatus. Daniel V. Sherban, Canton, Ohio, assignor to The Bonnot Company, Canton, Ohio.—1,558,119.

Drying Apparatus. Charles C. Colbert and George E. Preston, Elkhart, Ind., assignors to American Coating Mills, Elkhart, Ind.—1,557,422.

Lumber Drier. James A. Craig, New Orleans, La., assignor, by mesne assignments, of one-half to Alexander T. McCurdie, Hattiesburg, Miss.—1,555,835.

Drier. Robert Cathcart, Cleveland, Ohio, assignor to The Lino Paint Company, Clevelannd, Ohio.—1,558,835.

Process of and Apparatus for Drying Materials. Hillhouse Buel, Seattle, Wash. —1,557,921.

Rotary Kiln. Mikael Vogel-Jörgensen, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y.—1,557,475.

Heat-Exchange Apparatus. Hans J. Zimmermann, Philadelphia, Pa., assignor to Schutte and Koerting Company, Philadelphia, Pa.—1,559,602.

Heat Exchanger. Emile Prat, Paris, France.—1,559,180.

Heat-Exchange Apparatus. Hans J. Zimmermann, Philadelphia, Pa., assignor to Schutte and Koerting Company, Philadelphia, Pa.—1,558,139.

Method of Conveying Heat Energy. John N. Dundas Heenan, Old Colwyn, England, assignor to Power Specialty Company, New York, N. Y.—1,558,871.

Refrigerating Apparatus. Harry B. Hull, Dayton, Ohio, assignor to Delco-Light Company, Dayton, Ohio.—1,556,689.

Filter. Heinrich Bechhold, Frankfort-on-the-Main, Germany.—1,557,234.

Filter. William D. Mount, Lynchburg, Va., assignor of one-half to Joseph E. Mount, Ithaca, N. Y.—1,558,038.

Filter. Henry Selby Hele-Shaw, London, England.—1,557,585.

Vacuum Pan. Clarence White, San Francisco, Calif.—1,558,957.

Method of Evaporation. Adolph W. Lissauer, Louisville, Ky., assignor to Louisville Drying Machinery Co. Inc., Louisville, Ky.—1,558,022.

Evaporator. Samuel T. Smith, Los Angeles, Calif.—1,556,132.

Distillation Apparatus. Joseph Schneible, Chicago, Ill.; Beatrice Schneible Ingram, administratrix of said Joseph Schneible, deceased, assignor to Claude D. Schneible, K. F. Schreiber, and Benjamin B. Schneider, as trustees under the name of The Schneible Trust.—1,557,112.

Separation of the Constituents of Gaseous Mixtures. Claude C. Van Nuys, Cranford, N. J., assignor to Air Reduction Company, Incorporated, New York, N. Y.—1,557,907.

Mixing Apparatus. Oscar Prieto y Cruz, Ponce, P. R.—1,558,669.

Method for Separating Materials. Thomas M. Chance, Philadelphia, Pa.—1,556,676.

Apparatus for Separating Unburned Coke from the Products of Combustion. Charles I. Boyer, Ridgway, Pa.—1,556,672.

Process of Decolorizing and Refining Gums and Resinous Products of Coniferous Pine Trees. Alfred R. Autrey, Port Arthur, Tex.—1,559,399.

Material for Decolorizing Liquids and Process of Making the Same. Philip L. Wooster, Manhasset, N. Y.; Lillian D. Wooster, administratrix of said Philip L. Wooster, deceased.—1,558,137.

Process for the Manufacture of Colloidal Substances in the Form of Small Balls or Grains. Albert Obersohn, Berlin-Charlottenburg, Wilhelm Wachtel, Berlin, Daniel Sakom, Wiesbaden, and Paul Askenasy, Karlsruhe, Germany.—1,559,126.

Silica-Lime Brick and Method of Producing the Same. Carl Mendius, Riverside, Ill., sasignor to Silica Brick & Engineering Company.—1,554,639.

Method for the Purification of Gases. Herman A. Brassert, Chicago, Ill., assignor of one-half to Charles W. Andrews, Duluth, Minn.—1,560,202.

Process of Refining Vegetable Oils. Cyrus Howard Hapgood, Nutley, and George F. Mayo, East Orange, N. J., assignors to The De Laval Separator Company, New York, N. Y.—1,560,084.

Leather-Degreasing Process. Albert J. Hanglin, Newark, N. J.—1,556,598.

Method of Making Insulators. John M. Peck, Cornelius Van Dyke Bennett, and James W. Ryan, Lima, N. Y., assignors to The Porcelain Insulator Corporation, Lima, N. Y.—1,558,498.

Process of Absorbing Vapors. Jéan Henry Brégeat, Paris, France.—1,558,336.

# News of the Industry

## Tax Reduction Proposed for Ethyl Alcohol

### Efforts Also Are Made To Place A Tax on Industrial Alcohol

Apparently sentiment in Congress is favorable to a reduction in the tax on ethyl alcohol. It is favored, rather half-heartedly, by General Andrews, the Assistant Secretary of the Treasury, in charge of prohibition enforcement. Wayne Wheeler, of the Anti-Saloon League, has no objection to it. There is some sympathy in Congress for the abolition of the tax altogether. The retention of the full tax was urged before the Ways and Means Committee by representatives of the American Drug Manufacturers' Association. That organization contends that the tax of $4.18 a gallon protects the alcohol it uses from diversion into illicit uses. The tax makes the cost of ethyl alcohol so high that it is not used in the concocting of beverages. Instead the bootlegger is forced to manipulate denatured alcohol which increases the chances of apprehension and discourages many from undertaking the preparation of beverages.

The retail druggists and the proprietary association characterize the levy on ethyl alcohol as a tax on the sick. The drug manufacturers claim no patent medicines or prescriptions will be sold for less to the ultimate consumer because of the few cents difference in the cost of ingredients.

Treasury officials are anxious to secure a tax of one cent a gallon on industrial alcohol and on cereal beverages so as to give them excise supervisory authority over their manufacture. They contend that illegal diversion can be prevented best if prohibition officials can keep plants under closer surveillance.

This is objected to by the manufacturers on the ground that the new supervision would burden them with another set of regulations and the obligation of complying with the exactions of another set of inspectors whose tendency is to be arbitrary.

Members of Congress seem to have little objection to the application of a tax on the near-beer beverages, but there is a very general appreciation of the fact that the prohibition regulations have placed many difficulties in the path of manufacturers of industrial alcohol. There seems to be every desire not to add to their burdens but the personal prestige of General Andrews is such as to make for a general desire to grant the recommendation.

## Advocates Removal of Duty on Sulphate of Ammonia

A representative of the Badische Company now in America is contending that the duty should be removed from ammonium sulphate. He has rallied considerable domestic support for his contention. With Chile saltpeter free of duty, as well as other fertilizer ingredients, he argues that the farmer should not be required to pay present prices for the ammonium sulphate which goes into his fertilizers.

## Lectures on Power Developments At Power Show

One of the features of the Fourth National Exposition of Power and Mechanical Engineering which will be held at the Grand Central Palace, New York, from Nov. 30 to Dec. 5 will be a series of lectures on the important developments in power and mechanical equipment during the preceding year. These are planned primarily for students but will be of general interest to mechanical engineers who wish to bring up to date their information on the rapid development in all phases of mechanical engineering. The list of topics which have been selected for presentation by leading authorities includes: Steam Prime Movers, Oil and Gas Engines, Steam Boilers, Modern Industrial Power Plants, Hydraulic Machinery, Machine Tools, Heating and Ventilating Equipment, Mechanical Refrigeration, Mechanical Power Transmission, Standardization, Materials Handling in the Power Plant, Materials Handling in Industry, the Steam Locomotive.

The lectures will be scheduled to avoid conflict with the sessions of the Annual Meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers which will be held in New York during the same week.

## Japan Offers Reparation Dyes To Textile Industry

Manufacturers of textiles in Japan are to have the first opportunity to bid on the government's reparation dyes. If sales are not arranged with those concerns they will be offered to the highest bidder. This does not apply to indigo. That dye will be sold to indigo importers. Bids will be received from Japanese firms only.

## F. T. C. Gives Authority To Use of Name Rayon

The Federal Trade Commission by an official resolution has placed the stamp of its approval on the use of the word "Rayon" as properly designating artificial silk products, the basis and chief ingredient of which is cellulose.

There have been before the Commission a number of cases involving the misbranding of textiles which have artificially been given the appearance of silk, and have been sold under trade names containing the word "silk" or a modification of the word "silk." In deciding these cases the Commission has consistently held that hosiery or other products which simulate silk but are not the product of the cocoon of the silk worm should be branded with the words "Artificial Silk" or other words which correctly describe the materials composing the article branded.

The word "Rayon" has been adopted by many associations of manufacturers as a proper one for artificial silk products and the term has been extensively advertised to the public. The commission therefore believing that both the trade and the public have come to accept and recognize the word "Rayon" as being applied to artificial silk or a substitute for silk, passed a formal resolution in which the term "Rayon" is accepted as a proper designation for artificial silk products.

## Merger of Canadian Asbestos Companies Completed

Announcement has been made of the incorporation in Canada, with federal charter, of the Asbestos Corporation, Limited. This is the new organization which will bring the long-heralded merger of Quebec asbestos companies into effect, and which has been under negotiation for several months past. The fact that the charter for the new corporation has been secured, is taken to indicate that the progress which has been made more recently by interested companies and persons. has been substantial. The action of the Quebec Superior Court in refusing to allow the interlocutory injunction against the merger also brings the final deal closer to fulfillment than ever before. Under the provisions of the charter, the new corporation will have the power to carry on its operations throughout the Dominion and elsewhere under the name Asbestos Corporation Limited. The headquarters of the company will be in Montreal.

# Chevreul Centenary Features Congress of Industrial Chemistry

## Carbonization, Metallurgy, and Explosives Among Other Subjects Discussed at Fifth International Meeting

*Special Correspondence to Chem. & Met.*

THE FIFTH Congress of Industrial Chemistry which was held in Paris October 4-11, was one of the most notable of the recent international gatherings. More than 500 delegates representing 18 countries were present at the concluding feature of the Congress, where, in the presence of the President of the French Republic and other distinguished officers of the Government, an impressive ceremony was held to celebrate the centenary of Chevreul's classic investigations on the chemistry of oils and fats. To this great pioneer was accorded the honor of laying the foundation for the modern soap, candle and fat industries. The United States, on this occasion, was represented by Professor Harry N. Holmes, delegate of the A. C. S. and the American Association for the Advancement of Science, A. M. Patterson of the American Electrochemical Society and M. de Wendel of the A. I. M. E.

The opening session on October 5 was held under the chairmanship of M. Lucien Dior, former Minister of Commerce. The Congress was welcomed on behalf of the French Government by M. Borel, Minister of the Department of the Marine. Dr. Leon Guillet, the eminent metallurgist, spoke on the influence of science on the evolution of metallurgy, reviewing the many contributions made to the industry during the 19th century by the British metallurgists, Bessemer, Siemens, Gilchrist and Thomas. Sir Robert Hadfield representing the Iron and Steel Institute of Great Britain, pointed to the equally important contributions of Pourcel, Osmond, LeChatelier and Dr. Guillet, himself.

### Discussion of Explosives

Low-temperature carbonization came in for discussion in two papers, one by Charles Berthelot and the other by Edgar C. Evans. Neither speaker sponsored present practice in low temperature carbonization, both seeming to imply that a compromise between high and low temperature carbonization was more sound economically at the present time. Among several well-received papers dealing with explosives, was a discussion of the trinitrobenzoates resulting from the decomposition of trinitrotoluol. M. M. Kranz and Turek pointed out that the trinitrobenzoates were particularly sensitive to detonation by shock or heat. The explosiveness of TNT containing even minute quantities of these compounds, especially their metallic derivatives, is greatly increased. In the presence of moisture the trinitrobenzoic acids attack iron, copper and lead very rapidly, yielding explosive derivatives. In view of the fact that commercial TNT may contain trinitrobenzoic acids, care should be taken in handling and storing this material. G. Pandele read a paper on "Safety Considerations in the Manufacture of Military Explosives."

The subject of liquid fuels, which had featured the preceding Congress came in for discussion by M. Guiselin, who recommended the standardization of all methods and apparatus for examining the petroleum products used in France. M. Moureu, who for a number of years has been studying the phenomena of auto-oxidation, reported that his experiments had led him to believe that the anti detonating action of certain materials when added to motor fuels was due to the catalytic effect of auto-oxidation.

### Progress of Synthetic Resins

Georges Kimpflin made a statement of the progress now being effected in the manufacture of synthetic resins. The study on milusite, a condensation product of phenol, has shown that we are on the way to reducing by one third the time needed for the complete polymerization of the artificial resin varnishes. The study also contributed to our knowledge of the breaking tension of binding materials used in molding. This tension increases according to the thickness of the film, but not, as was believed, proportionately. It also varies according to the nature of the resin and the time of its heating. A desire was expressed that the international congress should take up the study of the nomenclature and terminology of the synthetic resins.

M. Kaltenbach's paper on the manufacture and concentration of nitric acid held the attention of the heavy chemical group. He pointed out that the synthetic process yielded an acid of only about 50 per cent concentration and that this strength could be raised only to 65 per cent by heating. It is then necessary to employ a dehydrant such as sulphuric acid and, because the amount of heat thus generated is not sufficient to volatilize the nitric acid from the mixture, steam heating must be employed. The exact control of the steam and the best method and equipment for applying it were described by M. Kaltenbach.

## Study of Rayon Possibilities in Piedmont Section

A complete investigation of the possibilities of rayon production in the Piedmont section of the Carolinas is now being made by a group of manufacturers under the leadership of H. Smith Richardson, president of the Vick Chemical Co. of Greensboro, N. C. There has been an insistent demand for this product by the rapidly growing textile industry of the south, which has found that the use of a small percentage of rayon in cotton goods adds greatly to the salability of the fabric.

## Technical Program Arranged for Meeting of A. I. C. E.

The 18th annual meeting of the American Institute of Chemical Engineers will be held in Cincinnati, Dec. 2 to 5, 1925. Headquarters will be at the Hotel Sinton, where the technical sessions will be held on Dec. 2 and 3. The session on Dec. 4 will be held at the University of Cincinnati.

The Cincinnati section of the Institute has arranged for inspection of a large number of industrial plants, among them American Diamalt Co., Federal Products Co., Wadsworth Watch Case Co., Rookwood Pottery, Proctor and Gamble, American Oak Leather Co., Eagle-Picher Lead Co., Formica Insulation Co., Lippincott Co., Richardson Co., and the Strietmann Biscuit Co.

On the evening of Dec. 2 there will be a dinner at the Hotel Sinton, followed by a concert by the band of Syrian Temple Shrine. This will be followed by a dance. Another dinner will be given the evening of Dec. 4. Special arrangements have been made for the entertainment of ladies.

The annual business meeting and election of officers will be held at the Hotel Sinton, Dec. 3, at 9 a.m.

Pullmans have been reserved for eastern members of the Institute on the new Baltimore & Ohio train, the National Limited, leaving New York Tuesday, Dec. 1 at 12:50 p.m., arriving at Cincinnati Wednesday at 8:40 a.m.

The technical program includes the following papers:

**Wednesday, Dec. 2.**

Chemical Engineering in the Cincinnati District. G. C. Smith.

The Resources of the Cincinnati District. C. H. Behre, Jr.

Wastage of Platinum, of Platinum-Iridium and Tantalum as Cathode Materials. Franklin P. Lassiter and James R. Withrow.

Comparative Heat Transfer Through Metal and Pyrex Tubes Under Plant Conditions. Dr. J. T. Littleton, Jr. and H. C. Bates.

The Correlation of Physical and Chemical Properties in Alloys of the Ternary Type. Lyman J. Wood and S. W. Parr.

**Thursday, Dec. 3.**

Costs of Nitrogen Fixation by the Synthetic Ammonia Process. F. A. Ernst.

Transportation and Labor as Factors in Selecting Plant Sites. A. E. Marshall.

Water Supply as a Factor in Locating Chemical Plants. W. D. Collins.

**Friday, Dec. 4.**

Twenty Years of the Co-operative System. Dr. Herman Schneider.

Chemical Engineering Under the Co-operative System. R. S. Tour.

The Research Laboratory of the Tanners Council. George D. McLaughlin.

The Solid Liquid Temperature Relation in the Ternary System $H_2SO_4$-$HNO_3$-$H_2O$ and Its Relation to the Ternary System $N_2O_5$-$H_2O$-$SO_3$. Clifford D. Carpenter and Alexander Lehrman.

# News from Washington

**By Paul Wooton**

WASHINGTON CORRESPONDENT OF *Chem. & Met.*

GERMANY is known to be reaching the point where it will enter the world market with its fixed nitrogen fertilizers. In 1913 that country imported 775,000 tons of nitrate of soda from Chile. During the calendar year of 1924 the entire importation of saltpeter amounted to 11,000 tons.

This remarkable showing was made possible largely by the Haber-Bosch process of direct ammonia synthesis. Thus in the short period of fourteen years this process has been developed to the point where it may threaten the Chilean nitrate industry, which previously had been regarded as one of the most strongly intrenched of the great world monopolies.

Germany is said to be in a position to compete successfully in the American market at present and plans are being laid to that end. It is realized, however, that Chile will probably forego the export duty before allowing any great inroad to be made into its American market. For that reason every effort now is being concentrated in Germany to reduce costs. The German industry has already made some progress in that direction. Lignite has been substituted as a fuel. Gypsum is being used to some extent as a source of sulphate for ammonium sulphate. In preparation for the day when they must meet nitrate of soda stripped of its export tax and of some of its present costs, the German manufacturers are making a major effort to effect other economies. The greatest saving is promised through the substitution of brown coal for coke in the production of hydrogen. The enormous consumption of coke for this purpose has been the most burdensome of the costs.

### Muscle Shoals Reports

The majority and minority reports of the Muscle Shoals Commission are nearing completion. There still is some rumor that there are to be three reports, but it is believed that Senator Dial will be content to sign the report on which Chairman McKenzie and Commissioner Bower are agreed, so long as he is allowed to express certain additional views.

So far as is known the majority members of the Commission have not conferred with the secretaries of War, Commerce and Agriculture in the formulation of their conclusions. Commissioners Curtis and McClellan, however, are known to have observed scrupulously that portion of their instructions.

The finishing touches are being put on the majority report by Commissioner Bower and W. G. Waldo, the Commission's technologist. It is believed that the majority report recommends a large subsidy for the operation of the nitrate plants. It is on this point principally that the Commission has split. It is thought that Commissioners Curtis and McClellan insist on the separation of fertilizer production and the generation of power. They oppose any subsidy, whether in the form of power or otherwise, for fertilizer production and are unalterably opposed to allowing the government itself to be set up in a fertilizer business.

### Vegetable Oil Hearings

Hearings in the vegetable oil case before the U. S. Tariff Commission will begin January 4, according to present arrangements. A vast amount of data have been gathered by the Commission in this case. The record which has been built up is by far more voluminous than that of any other investigation which the Commission has undertaken. In fact the task of preparing a summary of the evidence is so great that it may be necessary to postpone the opening of the hearings. The summary must be sent to those concerned thirty days before the hearings.

The summary in this case, in addition to a detailed study of production costs, will include a survey of the entire world movement of cottonseed, peanut, soya bean and cocoanut oils, as well as of other oils regarded as subsitutes.

The case was undertaking following an application by the Bureau of Raw Materials, an agency of the industrial consumers of vegetable oils, for a fifty per cent reduction in the duties applied by the tariff act of 1922. The farm organizations are opposing the application and have assembled a large amount of data to support their side of the case.

The stronger Interessen Gemeinschaft apparently is the handiwork of Dr. Carl Bosch, of Ludwigshafen. He seems to be the organizing genius who has been able to fuse unwilling interests at a time when the tendency in other lines of Germany industry is toward disintegration. The great advantage of having final administrative authority under one hat seems to have been achieved in the German dye industry.

No new companies have been taken into the combine—in fact one company was dropped—but the new arrangement concentrates authority and does away with all the independence formerly enjoyed by the constituent companies. The total capitalization of the reorganized concern is 646,000,000 marks.

Some of the companies surrendered their liberty of action very reluctantly. Lack of capital and the increasing pressure of foreign competition made acceptance imperative. The new agreement will make possible new economies through co-ordinating certain manufacturing processes, but the chief immediate effect will come through the unification of the sales organizations. The headquarters of the Badische will be transferred from Ludwigshafen to Frankfort.

While the unemployment situation is such that manufacturing activities cannot be consolidated and reallocated at the most advantageous points at once, it is expected that this trend will proceed gradually. The I. G. as now constituted is composed of the following companies: Badische Anilin; Leverkusen; Hoechster Farben; A. G. für Anilin; Griesheim-Elektron; Weiler ter Meer and Cassela.

Isopropanol is not an intoxicating liquor insofar as can be determined from present knowledge. This conclusion was reached at a federal interdepartment conference called by the Surgeon General of the Public Health Service last month.

The decision that the Volstead act does not apply to isopropanol puts the Bureau of Chemistry in a position where it must decide whether or not this alcohol produces other physiological effects which made it undesirable to use in foodstuffs. There is a demand on the part of certain food industries for an alcohol which does not come within the purview of the Volstead act. Its use would free manufacturers from many of the burdensome regulations which check use of grain alcohol.

### Tungsten Tariff Discussed

Evidence of activity in behalf of producers or potential producers of tungsten has become manifest in Washington. Whether the intention is to attempt to amend the tariff act so as to increase the duty on tungsten or whether the plan is to induce the Tariff Commission to increase the duty under the flexible provisions of the law, has not been revealed. Whichever line the activity takes it is believed that the attempt is foredoomed to failure.

The chances are very much against any opening of the tariff at the coming session. Even if some amendments to the act can be pushed through, it is certain that they will be only those which have behind them wide popular support. Insofar as the Tariff Commission is concerned it seems hardly likely that an increase will be granted on a commodity now enjoying a duty of $7.14 short ton unit when it is considered that the British price is less than $2.50 a unit. This rate of duty is equivalent to an advalorem duty of 285 per cent. More than three years of this amount of protection has brought forth very little domestic production. Colorado, which was to become a large producer under the existing high duty, has no single property in operation.

Because of the highly specialized character of the problem as to the ceramic work of the Bureau, Secretary Hoover determined to leave the solution of it to the industries directly concerned. Representatives of these interests assembled in Washington, November 6. They found themselves to be in complete accord in the matter of consolidating ceramics research in one agency, but there was distinct difference of opinion as to whether or not the consolidated efforts should be administered by the Bureau of Mines or by the Bureau of Standards.

## News in Brief

**Rayon Industry Prospers in Germany**—The rayon industry is young but one of the few booming, and most profitable industries in Germany, notwithstanding unfavorable financial conditions, high taxes, and other disadvantages affecting economic life in Germany at the present time, says a recent report from Consul A. T. Haeberle. There are about 12 principal factories of artificial silk in Germany, working primarily according to the viscose system. A number of these mills manufacture their own machines. In general, the mills operate according to own patents and improvements, but keep them and the interior of their plants secret.

**New Porcelain Factory for California**—Using Mojave Desert clay as the essential raw material, a new Coors porcelain factory will soon start operations at a site on Redondo Blvd., Inglewood, Calif. The first unit of the plant will have a capacity of about 30,000 pieces per month, including high-class chemical porcelain ware.

**Laval University Will Establish Chair of Chemistry**—Following the establishment of a chair of industrial chemistry in McGill University, Montreal, as a result of a bequest from the E. B. Eddy Estate, Laval University will also establish a chair of chemistry in its new chemistry school, as a result of the receipt of a donation of $100,000 from Hon. George E. Amyot, president of the Dominion Corset Company, and a legislative counsellor of Quebec. It will be called the Amyot chair.

**Dr. Prescott Speaks Before Connecticut Chemists** — The Connecticut Valley Branch of the American Chemical Society held its first Fall meeting Nov. 7 at Westfield, Mass. Dr. Samuel C. Prescott, of the Massachusetts Institute of Technology, addressed the members of the society and took for his topic, "The Place of the Laboratory in Safe Guarding Public Health." All the members spent the forenoon on a tour of inspection and visited the Springfield Water Works' system at Mundale, Mass. In the evening the members enjoyed a banquet at the Baldena Inn, in Westfield, which was followed by a general business discussion and several addresses by society members.

**Proposed Platinum Combine in London**—A great combine to establish a platinum market in London is being planned, according to London press reports which are quoted in a report to the Department of Commerce. Negotiations have been taking place recently with a view to handling all sales of South African platinum, but as no mines have been opened there a definite plan for sales operations has not yet been completed.

Since the Russian revolution the supply of platinum from that source has been almost entirely cut off, and as Russia satisfied a considerable part of the general demand the change has had a marked effect on the market. The world production of platinum is small, making the report of extensive deposits in South Africa an important one. Until recently the metal has been found generally in gold mines.

**Gypsum Plant Will Carry No Insurance Protection**—The Ontario Gypsum Co., Ltd., which has just completed construction of a half million dollar plant in Montreal East, makes the rather novel announcement that not a cent of fire insurance is to be placed on the plant. The reason given for this decision is that the material used for the construction, namely gypsum, has been shown to be absolutely fireproof. It was also stated that an attempt to burn a gypsum building in Toronto had failed.

**Shellac Company Cited by Federal Trade Commission**—In an order issued by the Federal Trade Commission the Ohio Shellac Company, of Cleveland, Ohio, is required to discontinue the misbranding of shellac substitutes which it sells to the trade and quantity consumers under the brand names of "Dutch Main Shellac" and "Ohio Shellac." Myron J. Freeman and Myron Lewis are named individually and as partners in the company.

**Proposed Elimination of Undergraduate Work at Johns Hopkins**—The Board of Trustees of the Johns Hopkins University, Baltimore, Md., has approved preliminary plans for the elimination of two years of undergraduate work at the institution. Efforts are now being made to raise funds for the introduction of the departure. In order to make up the loss of revenue resulting from the move, it is estimated that close to $6,000,000, will be required. The plan, it is stated, will not only save two years' of schooling for the student, but will raise the standard of the university. Entrance requirements, also, will be changed in that only students desiring to follow specific profession will be admitted.

**Germans Use Bakelite As Lining Material**—Much success is said to be attending German use of bakelite for the lining of apparatus and containers to be subjected to sudden temperature changes or to be exposed to acids.

**Production of Liquid Carbonic Acid in Sweden**—A company with a large capital will soon start in the production, at Stockholm, of liquid carbonic acid and other compressed gases. All the preparatory work is finished and the installation of machinery has been begun. Liquid carbonic acid was previously produced by only one factory in Sweden.

### Inquiry Into Cost of Dyes Used in Textile Materials

Acting under its general powers to gather information, the Tariff Commission has begun an inquiry into the cost of dyes in textile materials. The question has arisen frequently in the past as to the cost of dyes in men's suits and other garments, and in women's wearing apparel, as well as in piece goods. Dr. W. N. Watson, color specialist of the Commission's Chemical Division, has gone to New York and New England to secure figures from dye manufacturers, textile manufacturers and garment manufacturers on this subject.

### Appeal in Chemical Foundation Case To Be Argued Dec. 7

Reiterating its contention that the sale of seized German dye and chemical patents to the Chemical Foundation, Inc., was the result of a conspiracy, was made without authority and tended to give the Foundation a monopoly in violation of the Sherman act, the government has filed with the United States Supreme Court its brief in support of its appeal from the adverse decisions of the lower courts in its suit against the corporation. The appeal has been set for argument Dec. 7.

In the brief filed with the Supreme Court, the government asserts that efforts have been made to put it in the position of having reflected personally upon former high officials of the government. In denying such intent, the brief makes it clear that there is and has been no intent to reflect upon former President Wilson, former Attorney General Palmer or former Under-secretary of State Polk, each of whom is specifically exempted from blame in connection with the acts against which the government complains.

### Government Seeks Data On Distribution of Graphite

Users of graphite have received a questionnaire from the Tariff Commission intended to establish the amount of graphite consumed in different uses. Despite all of the consideration and discussion of graphite during recent years, it seems that no government agency has even approximate figures as to the amount of graphite used in batteries, in lead pencils, in crucibles, in pigments and in other purposes.

While the electric furnace practically has superceded the crucible, which is made of crystalline graphite, in nonferrous industries, and is fast supplanting it in ferrous activities, there has been a corresponding upturn in the demand for amorphous graphite. Most of the uses of this latter form of graphite are expanded, particularly the production of dry batteries, pigments and lubricants containing graphite. Apparently the coming of the mechanical pencil is adding materially to the amount of lead consumed in writing.

### Australia Will Admit Canadian Newsprint Duty Free

In connection with the recent announcement that the trade agreement between Australia and Canada has been ratified by both governments, it is noted that while the concessions granted by each country include a wide variety of products, the chief interest lies in the fact that the newsprint manufacturers of Canada will be able to export their product to Australia free from tariff charges, as compared with the present duty of $15 per ton. Under the new conditions, it is expected the Canadian mills will be enabled to capture a good share of the business in Australia which country, it is estimated, at the present time uses about 100,000 tons of newsprint per year.

# France Is Increasing Home Supply of Nitrogen-Carrying Products

## Production Still Falls Far Short of Possible Annual Consuming Capacity Estimated at 400,000 Metric Tons of Nitrogen

*From Our Paris Correspondent*

THE question of nitrogen in France is important for this country is preeminently an agricultural one which by intensive cultivation could be brought to meet its demands for practically all kinds of food-stuffs. But it is only exceptionally that French soil yields the cereal crops consumed in the country—about 95 million metric quintals per year. This is due to the methods of cultivation imposed by the extreme division of property and more particularly by the insufficient fertilizer used. Although France produces and consumes phosphate fertilizers in great quantities,—in fact is the largest producer of superphosphates and in addition has Thomas slag from the Lorraine iron-works—she consumed before the war but little potash which had to be imported from Germany and little nitrogen as well.

In 1913 France consumed 320,000 tons of sodium nitrate representing 48,300 tons of nitrogen; 96,000 tons of ammonium sulphate equivalent to 19,200 tons of nitrogen; 16,000 tons of cyanamide equalling 3,000 tons of nitrogen and 5,900 tons of synthetic calcium nitrate yielding 770 tons of nitrogen, i.e. a total of 437,900 tons of nitrate fertilizers corresponding to 71,270 tons of nitrogen. Germany, which has the same area as France, consumed in that year, 215,000 tons of nitrogen or three times the quantity used in France.

Of the nitrogen consumed in France in 1913, only 17,000 tons were produced in the country. The difference of 55,000 tons had to be imported. In 1924 our production has made big strides; but of the 93,000 tons which we consumed, we actually produced but 30,000 tons. In spite of this enormous increase, we are far from the possible consuming capacity of the French market. We reckon indeed that in order to give to our 23 million hectares of tillable ground, the 15 to 20 kg. nitrogen necessary per hectare, would require 400,000 metric tons of nitrogen.

Praiseworthy efforts due to private initiative and to the state have already been made to organize and stimulate the production of nitrogen. A few companies make ammonium sulphate by fixing the nitrogen of the air. The Collieries of Aniche and the Société Chimique de la Grande Paroisse have set up a branch establishment for applying the Georges Claude process to treat a part of the gases of the coke-ovens. The Société de la Grande Paroisse co-operates also with the Compagnie des Mines de Bethune. The Kuhlmann works and the Collieries of Anzin have come to an agreement in view of utilizing the Casale process on the coke-ovens of Anzin for the making of sulphate of ammonia. A consortium has been established for applying the same Casale process among the Compagnie d'Alais, Froges, Camargue, the Collieries of Vicoigne, Noeux and Drocourt, and those of Sarre & Moselle.

The Société des Phosphates Tunisiens is setting up a French company with the view of making synthetic nitrogenous fertilizers according to the Fauser process. They have secured in the Pyrenees the energy necessary for their additional production.

The State encourages nitrogen production under the form of premiums or reductions in taxes. Moreover, Germany delivers under the reparation plans a certain compliment of nitrogenous fertilizers. According to the Versailles peace treaty, Germany had to deliver during three years, beginning with the signature of the treaty, 30,000 tons per year of ammonium sulphate. New agreements were reached in 1922 to secure the continuation of these deliveries.

### Government Operated Plant

After the armistice, in 1919, Mr. Loucheur, secretary of the Board of Trade and Industry, acquired in the name of the government a license of the Haber-Bosch process owned by the B. A. S. F. at Oppau and Merseburg. Owing to administrative inertia and other causes, this process, which was to be exploited by a private company has been temporarily abandoned. It will, however, be utilized by the State represented by the Office Industriel de l'Azote, an organization which has been created in France by an act of April 11, 1924. It is ruled over by a committee composed of 18 members consisting of interested administrators, agricultural associations, the producers of electrical energy and coal mines and specialists of the nitrogen industry. It is presided over by Georges Patart, Inspector General of Powders and Saltpetres, the holder of the French patents on synthetic methanol.

This National Office has for its mission the making of all fertilizers according to all processes, the patents of which it can secure, but it enjoys no monopoly. To realize its program, Parliament voted it from the outset a credit of 30 million francs for the purpose of buying the necessary material and of transforming the powder-plant of Toulouse which has been selected as the new factory of the state.

The construction of the plant for the making of the hydrogen has been assigned to the firm of Schneider & Co. For this production they had planned to use the process of the B. A. S. F. and of B. A. M. A. G. However, at the last moment, according to authoritative information the installation has been stopped owing to the fact that no decision has yet been taken concerning the type of the gas-producers to be adopted.

The production of the ammonia itself will be done accordingly to the Casale process although the Office has the rights to the Haber-Bosch process the application of which was first contemplated. The Compagnie des Produits Chimiques d'Alais, Froges, Camargue has the contract for installing the plant in which the synthesis will be realized.

To satisfy public opinion which finds that the operations are rather slow, the Government has expressed the desire that a part of the projected installations should be put into operation by June 1926 at the latest. Something will undoubtedly be done to meet this desire, but we are justified in saying, after personal information, that there can be no real industrial production before June 1927. Here, in France, State control is more of a brake than an accelerator. Meanwhile we import yearly 300 million francs worth of nitrates and 115 million francs of ammonium sulphate.

The Claude process which is already being applied at the Mines of Béthune, is to be used in new plants by the Collieries of Aniche, likewise employing the gas from the coke-ovens. Another plant, using the Claude-process, has been installed at Decazeville by the Société de Commentry-Fourchambault. The industrial opening of this plant was to take place in the beginning of September, 1925, but it still remains in the experimental state. It is a question of a plant yielding 5 tons per day. The Collieries of St. Etienne have likewise set up a Claude plant of 5 tons which, as far as we could know, is actually producing well.

As regards the Casale process the following firms are direct or sub-licensees: the Compagnie d'Alais, Froges, Camargue which has at St. Auban a plant already producing 700 tons of ammonia; the Collieries of Lens—7,500 tons; Anzin-Kuhlmann—7,500 tons; Dourges—5,000 tons; Vicoigne—5,000 tons; and Sarre and Moselle—5,000 tons.

The five last companies are grouped in one organization with a capital of 10 million francs under the name of Société Ammonia with main office at Lens. The latter company which is charged with setting up the necessary plants for the production of synthetic ammonia in the different mines which it controls, had to defend a lawsuit against Claude who claims that the Casale process, for which these mines have a license, was an infringement of his own. Claude lost the suit quite recently. At present the Société Ammonia is busy equipping coke-ovens for its adherents in view of producing nitrogen. To these producers are to be added the society Engrais Azotés et Produits Chimiques of Soulom with 13,500 tons and finally the National Office of Nitrogen at Toulouse with 56,000 tons of ammonia per year. These plants correspond—the powder plant of Toulouse excluded—to 45,000 tons of ammonia, i.e. 37,000 tons of fixed nitrogen.

With all the plants just enumerated, the production of 110,000 tons of fixed nitrogen per year can be turned out. These figures are not too ambitious considering the absorption capacity of the French market.

# New German Dye Trust Will Complete Organization Soon as Possible

### Four Production Units Will Be Established With Five Central and Regional Sales Units

IN CONNECTION with recent reports which have come from Germany to the effect that the leading dye and chemical concerns in Germany had been merged into a vast organization, an official communication has been received by the Chemical Division of the Department of Commerce.

According to this communication the firms of the I. G. of the German dye industry have come to an understanding with reference to the unification of their manufacturing and sales organization for the purpose of increased unity, cost reduction and improvement of quality. As soon as the necessary preliminary measures are accomplished, the fusion proposal will be laid before the general assemblies of the various companies.

The fusion provides for the inclusion of all firms, with the exception of Casella and Kalle, whose control and shares are actually in possession of their firms and which are in reality subsidiary companies, into the Badische Anilin and Soda Fabrik. The Ludwigshafen Co. will then exchange its shares for the shares of the above companies, received in the ratio of one to one, and issue new shares against the same nominal amount, thus increasing its capitalization by that of the companies taken over. The name of this fusion company will then be the I. G. Dye Industry Co. and its head office will be transferred to Frankfort. The firms taken over in the fusion will retain their former names as subsidiary companies.

Four production units will be organized out of the numerous manufacturing plants of the I. G. and of their affiliated companies. These original organizations will cover the Upper Rhine, the Middle Rhine, the Lower Rhine, and Central Germany. The numerous sales bureaus for the different types of products will be organized into five central and regional sales units.

It is expected that the new board of directors will be composed of the former directors under the chairmanship of Dr. Boach of Ludwigshafen. The new supervisory board will likewise be drawn from the previous boards. In addition will be added the present chairmen of the former boards of directors. These latter, formerly belonging on the central council of the I.G., will be made into a committee of the Aufsichtsrat (Supervisory Board), called the Verwaltungsrat (Administrative Board) which will take over the control and transition into the new company, and will effect through division of Labor.

The chairman of the Aufsichtsrat and of the Verwaltungsrat will be Dr. C. Duisberg of Leverkusen. The vice chairman of the Aufsichtsrat will be Dr. W. von Rath of Hoechst, Dr. C. Mueller of Ludwigshafen, and C. von Weinberg of Frankfort; and of the Verwaltungsrat Dr. A. Haeuser of Hoechst, and C. von Weinberg. The new organization will be effected as soon as possible.

The Berlinger Boersen-Zeitung in commenting on the merger stated that this new transaction completes efforts which have been carried on for many years and which is based partly on the technical developments of the German chemical industry and partly on the lack of capital. It can be said that this affiliation was formerly rejected by several firms for reasons of prestige but now is accepted under the necessity of present conditions. The union which was made between the Badische Anilin and Soda Fabrik, the Elberfeld Dye Co., and the A. G. fuer Anilin Fabrication in the year 1904, for the duration of 50 years, experienced in 1916 an expansion to include the Farbwerke, formerly Lucius and Bruening at Hoechst on the Main, Leopold Cazella & Co., Frankfort, Weiler ter Meer in Uerdinger, Kalle & Co. in Bierbrich, and Griensheim - Chemical Manufacturer in Frankfort. The duration of this expanded community of interest was extended to 50 years, (to 1966). Now this looser form of union is given up and the closest type of fusion chosen in which only the smaller firms of Casella and Kalle are excluded because their control is actually in the possession of other firms.

From the fact that Bosch has been made the chairman of the board of directors of the new company, one can conclude that the entire transaction was predominantly a result of his own initiative and built upon his own plan.

The total capital stock of these companies in the I. G. amounts to 641,600,000 marks in addition to 4,400,000 marks, preference shares, giving the Konzern a total capitalization of 646,000,000 marks. Nothing is said as to what will be done with the bonds outstanding and this is probably not yet certain. Approximately 8,680,000 marks of bonds are outstanding. The following table gives a survey of the share.

## Selection of Chemistry Chief for Bureau of Standards

The Civil Service Commission states that the position of chief of the Chemistry Division of the Bureau of Standards is vacant, and that, in view of the importance of the position in the whole field of chemical research, and to insure the appointment of a thoroughly qualified man for the work, an unusual method of competition will be followed to fill the vacancy. Instead of the usual form of civil service examination, the qualifications of candidates will be passed upon by a special board of examiners, composed of Dr. George K. Burgess, Director of the Bureau of Standards; Dr. F. G. Cottrell, Director of the Fixed Nitrogen Research Laboratory of the Department of Agriculture; Dr. W. A. Noyes, Dean of Chemistry of the University of Illinois; Dr. W. R. Whitney, Chief of the Research Laboratory of the General Electric Company, and Mr. Frederick W. Brown, Examiner of the United States Civil Service Commission.

The examination will consist solely of a consideration of qualifications by this special board. The minimum qualifications for consideration are a Doctor's degree in chemistry from a college or university of recognized standing, and at least ten years' experience in the direction and performance of chemical research of a character to show the required degree of chemical knowledge and ability, executive capacity of the highest order, thorough familiarity with chemical literature, and scientific maturity.

## New Sulphuric Acid Plant in Operation in Canada

The new sulphuric acid works at the smelter of the Mond Nickel Company, Coniston, Ont., Canada, has been completed and is now in successful operation. This plant is designed on the latest and most approved lines, using the contact process. All strengths of acid will be produced, including oleum. This development marks the first successful effort to save the sulphur, hitherto going to waste in the Sudbury district, and owing to the lower cost at which the acid will be produced, it is expected that the consumption of this important raw material will be stimulated in Canada.

## Favorable Tests in Carbonizing Saskatchewan Lignite

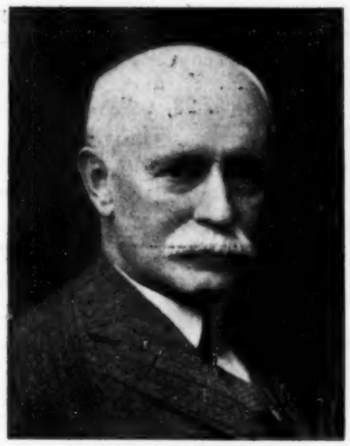
The carbonizing and briquetting tests with Saskatchewan lignite, carried out during the past summer at two of the largest briquetting plants in Germany, Thyssen and Co., at Mulheim-Ruhr and the Lurgo Co. at Frankfort, were technically successful, according to a verbal report by W. G. Worcester, professor of ceramics engineering at the University of Saskatchewan, who personally took charge of the shipment of 52 tons of lignite from the mines of the Western Dominion Collieries at Taylorton, and went to Germany to see the tests carried out. Prof. Worcester's report, dealing with the various tests carried out will not be ready for some weeks, but the members of the Lignite Utilization Board have expressed themselves as well pleased with the preliminary report received.

## Only Few Chemical Exhibits at Leipzig Fair

The large chemical concerns in Germany were conspicuously absent from the Autumn fair at Leipzig. An exception was the Griesheim Elektron which featured its "Tripolit" a preparation for removing rust. Another exhibit which attracted attention was a benzine "isolator." It permits the recovery of benzine from the wastes of plants where losses of the chemical occur during processes.

# Men You Should Know About

Dr. WILLIAM PITT MASON, head of the Department of Chemical Engineering at Rensselaer Polytechnic Institute, resigned on account of ill health, and on November 1 became Professor Emeritus. Dr. Mason, who was born October 12, 1853, received his C.E. from Rensselaer Polytechnic Institute in 1874, B.S. in 1877, and M.D. from Union University in 1881. He was assistant in chemistry at Rensselaer



Dr. William Pitt Mason

from 1875 to 1882, taught analytical chemistry from 1882 to 1893, and since 1893 has been professor of chemistry. Dr. Mason's special field has been sanitary engineering and water supply.

CHARLES E. KOCH has not resigned as chief chemist at the York plant of the Sandusky Cement Co., York, Pa., erroneously announced in our last issue.

Prof. J. A. NEWCOMBE, of Liverpool University, has arrived at the University of Toronto, to take over the duties of Prof. Ellis in the Department of Metallurgy, faculty of Applied Science and Engineering. Mr. Newcombe is a graduate of the Royal School of Mines, London.

Prof. WALTER G. WHITMAN has resigned as assistant professor in the department of chemical engineering and as assistant director of the research laboratory of applied chemistry at the Massachusetts Institute of Technology, to connect with the development department of the research laboratories of the Standard Oil Co. of Indiana, Indianapolis, effective in December. He will be succeeded at M.I.T. by Robert P. Russell, heretofore research associate in the department of chemical engineering.

LAFAYETTE D. VORCE is chemical engineer for the Chemical City Rayon Corporation recently organized to construct and operate a new Rayon mill in East China township near Marine City, Mich.

Dr. W. W. RANDALL of Baltimore, Md., has been elected president of the Association of Official Agricultural Chemists for the ensuing year. Dr. W. H. MacIntire of Knoxville, Tenn., has been elected vice-president; and Dr. W. W. Skinner, secretary and treasurer.

OWEN D. YOUNG, president of the General Electric Co., Schenectady, N. Y., has been appointed chairman of the American Committee of the International Chamber of Commerce, succeeding the late A. C. Bedford.

Dr. IRVING ANDREWS has become assistant professor of ceramic engineering at the University of Illinois, Urbana. During the past year he has been acting in a similar capacity at the New York School of Clay Working and Ceramics, Alfred, N. Y.

J. C. GENIESSE, of the chemical engineering department of the University of Michigan, Ann Arbor, has resigned to accept a position as research engineer for the Atlantic Refining Co., Philadelphia, Pa.

SYDNEY L. WELLER, formerly chemist for the Lee Tire & Rubber Co., Conshohocken, Pa., has become connected with the research department of E. I. duPont de Nemours & Co., Wilmington, Del., to specialize in synthetic colors, pigments, etc., in rubber products.

R. B. LADOO, formerly engineer with the Bureau of Mines, Washington, D. C., and later with the Southern Minerals Corp., Cleveland, Tenn., has accepted a position with the Colorado Fluorspar Co., Cowdrey, Colo.

U. G. LYONS, president of the Conewango Refining Co., Warren, Pa., has resigned on account of ill health.

Prof. HUGH S. TAYLOR, professor of physical chemistry at Princeton University, Princeton, N. J., and chairman of the committee on photo-chemistry of the National Research Council, Washington, D. C., has returned from a trip to Europe. Prof. Taylor attended the recent congress on photo-chemistry conducted by the Faraday Society of London, at the University of Oxford.

Prof. HAROLD HIBBERT, formerly assistant professor in chemistry at the Sheffield Chemical Laboratory of Yale University, is now professor of industrial chemistry and cellulose technology at McGill University, Montreal, Canada.

Prof. LEWIS B. ALLYN of Westfield, Mass., was elected chairman of the Connecticut Valley section of the American Chemical Society at its annual meeting held in that town Nov. 7.

PAUL D. V. MANNING is with the Inyo Chemical Co., which operates a plant at Cartago at Owens Lake, Inyo County, Calif. He is engaged in research and development work.

Dr. EDWARD ROBIE BERRY, of the General Electric Co., West Lynn, Mass., has been awarded the Grasselli medal for 1925, by the American Section of the Society of Chemical Industry, for his paper on "Manufacturing Uses of Fused Clear Quartz," read before the section March 20, 1925. The presentation will be made in Rumford Hall, The Chemists' Club, New York City, December 4.

STEPHEN A. IONIDES of Denver was recently in New York on a business trip.

P. B. YORK, formerly chief chemist for the Belle Alkali Co., is now chemical director of the electrolytic bleach department of the Champion Fibre Co., Canton, N. C.

Dr. RICHARD B. MOORE of The Dorr Co., New York, will be presented with the Perkin Medal, in Rumford Hall, Chemists' Club, New York City, January 15, by the American Section of the Society of Chemical Industry, for his work in the recovery of radium from carnotite and in recovery of helium from natural gas.

HENRY T. CHANDLER, who has been metallurgical engineer since Jan. 1, 1923, with the Vanadium Corp. of America, Detroit, has been appointed assistant to the president.

Dr. ALBERT WATSON DAVISON, professor of chemical engineering, at Rensselaer Polytechnic Institute, has been appointed head of the department of chemical engineering, to take Dr. Mason's place. Dr. Davison was a lieutenant and a captain during the

Dr. Albert Watson Davison

war, and supervised chemical plant construction and experimental operation at the Oldbury Electrochemical Co. In the Fall of 1921 he was appointed professor of chemistry at Rensselaer, succeeding Prof. A. T. Lincoln, who resigned. Dr. Davison was professor of physical and electrochemistry at the University of Cincinnati previous to the war.

Dr. C. J. THATCHER, who has been traveling in Europe, the Orient and Australia with his family for over a year, recently returned to his home at 161 E. 71st Street, New York City, and will resume his practice as an expert in patent causes. While abroad Dr. Thatcher renewed his acquaintanceship with many old foreign friends, including Prof. George Senter of Lon-

don, Fr. Fichter of the University of Basle, Switzerland, and Charles Fawcett, dean of the University of Sydney, N.S.W.

SCOTT TURNER of Lansing, Mich., has been selected for the directorship of the U. S. Bureau of Mines. He will assume his duties Dec. 14. The appointment of Mr. Turner was made on the unanimous recommendation of the Advisory Committee from the mining industry recently appointed by Sec. Hoover.

J. W. SWAREN announces the opening of an office in the Peoples Life Insurance Bldg., Washington, D. C., for consultation in the preparation of engineering data to be submitted before governmental departments and bureaus.

J. A. AMBLER, who has for several years been in charge of the Color Laboratory of the U. S. Bureau of Chemistry, has resigned. Dr. Ambler's successor has not yet been named.

D. J. PRICE has resumed his position as chief of the Development Division of the U. S. Bureau of Chemistry. Mr. Price has been absent from the Bureau during the past year doing special work at Penn State College and subsequently for a short time in a commercial connection in Pittsburgh.

W. LEE TANNER has severed his connection with the Grasselli Chemical Co., of Cleveland, and is now in charge of the chemical and physical laboratories of the College Inn Food Products Co., Chicago, Ill.

FREDERICK M. BECKET has been elected vice-president of the Union Carbide Co. Mr. Becket has for many years been associated with the company as chief metallurgist in charge of research development and the technical features of operation.

S. R. CHURCH has resigned from The Barrett Co. and has opened an office at 21 East 40th Street, New York, N. Y.

Dr. OSCAR VONMILLER, founder and director of the Deutsches Museum of Munich, Germany, which opened with national ceremonies on May 7 last, will arrive in New York about the middle of November.

ROBERT M. KEENEY is now industrial heating engineer of the Connecticut Light & Power Co., Waterbury, Conn.

MARSTON TAYLOR BOGERT, senior professor of organic chemistry in Columbia University has recently been appointed a member of the advisory board for the Bureau of Criminal Science, Police Department, City of New York.

RALPH I. BROWN, of the Pittsburgh Station of the U. S. Bureau of Mines, was awarded the Beal medal by the American Gas Association. This medal is awarded annually at the convention of the association to the author of the best technical paper presented at the preceding annual meeting. The title of Dr. Brown's paper at the 1924 convention was "Gummy Deposits in Gas Meters."

ROBERT B. HAND succeeds Emerson P. Poste at the Pfaudler plant at Elyria, Ohio. Under him Walter King will have charge of enamels, and Adolph Valley will have charge of the chemical engineering work.

### Calendar

AMERICAN CHEMICAL SOCIETY, 71st meeting, Tulsa, Okla., April 5 to 9, 1926.

AMERICAN CONSTRUCTION COUNCIL, Congress Hotel, Chicago, Ill. Nov. 18 to 21.

AMERICAN ELECTROCHEMICAL SOCIETY, Chicago Beach Hotel, Chicago, April 22, 23 and 24, 1926.

AMERICAN INSTITUTE OF CHEMICAL ENGRS., Cincinnati, O., Dec. 2 to 5.

AMERICAN SOCIETY FOR STEEL TREATING, Winter Sectional meeting, Hotel Statler, Buffalo, N. Y., Jan. 21 and 22, 1926.

CHEMICAL EQUIPMENT ASSOCIATION, Exposition, Cleveland, week of May 10, 1926.

NATIONAL ASSOCIATION OF PRACTICAL REFRIGERATING ENGINEERS, 16th Annual Convention and educational exhibition, Detroit, Mich., Dec. 8, 9, 10, 11 and 12.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING (Fourth), Grand Central Palace, N. Y., Nov. 30 to Dec. 5.

Dr. F. O. ANDEREGG, professor of physical chemistry of Purdue University has, by a special arrangement, been assigned to the chemical engineering department of that Institution.

Dr. C. D. LOWRY has accepted the appointment as research chemist for the Institute of American Meat Packers. John Yesair and Lee M. Roderick have also been added to the research staff.

H. W. WARNER, of Iowa City, has been appointed editorial agronomist for the Soil Improvement Committee (Northern Division) of the National Fertilizer Association. His headquarters will be in Washington.

B. L. JEPHSON of the London office of The Dorr Co. arrived in New York, October 6. He will spend some time in this country in intensive sanitary engineering training prior to returning to London where he will handle the sanitary engineering department of the company.

I. E. KNAPP, who for seven years has been in the dyestuff division of E. I. duPont de Nemours & Co., Wilmington, Del., working on the development of processes from the research laboratory through the semi-works into the plant, has resigned, and is now chief chemist with the Acme Products Co., DeQuincy, La., manufacturers of steam-distilled wood turpentine, pine oil and rosin.

R. V. TOWNEND, formerly chief chemist for the Victor Talking Machine Co., Camden, N. J., has resigned, and is now dean of chemistry at the University of Delaware, Newark, Del.

LYMAN CHALKLEY, formerly with the Standard Oil Laboratories at Whiting, Ind., has accepted a fellowship in the Research Division in the School of Chemistry and Physics at the Pennsylvania State College.

ROBERT G. DORT, formerly with the Knox Process Co., has been employed on the technical publicity staff of the American Cellulose and Chemical Manufacturing Co. of Amcelle, Md.

## Obituary

THOMAS FRANKLIN MANVILLE, chairman of the Board of Directors of Johns-Manville, Inc., died Oct. 19, 1925, in New York City, at the age of 63. For the past twenty-five years he was the directing head of Johns-Manville, Inc. His brother, H. E. Manville, who succeeded to the presidency of the company in 1924, was closely identified with him during this entire period and will continue to direct the policies of the organization.

WILLIAM F. MAHON, aged 67 years, for several years chief chemist and engineer for the Cattaraugus Tanning Co., Olean, N. Y., died at his home in that city, Sept. 23, following a sudden illness.

VIRGIL G. MARANI, chief engineer of the Gypsum Industries, died recently at his home in Evanston, Ill.

## Industrial Notes

THE CONVEYORS CORP. of AMERICA, Chicago, announces the appointment of Rowland & Burns, 39 Cortlandt St., New York City, as district engineers for New York and vicinity.

THE FOOTE BROS. GEAR & MACHINE Co., Chicago, announces that C. G. Wennerstrom, formerly of Allbright-Nell Co. of Chicago, has recently joined the engineering force of the company.

THE DRIVER-HARRIS Co. of Harrison, N. J., has purchased the works and properties of the Electrical Alloys Co. at Morristown, N. J., which will be operated as the Electrical Alloy Division of the Driver-Harris Co. The main executive offices and sales department will be concentrated at Harrison.

THE MIDWEST AIR FILTER, INC., and the Midwest Steel & Supply Co. have moved from their New York headquarters to Bradford, Pa., in order to consolidate organization, eliminate duplicate effort and maintain closer control of company activities. A branch sales office will be maintained at 100 East 45th St., New York City.

THE ROLLER-SMITH Co. of New York City announces that its Knoxville, Tenn., agent, The Tennessee Engineering & Sales Co., has opened a branch office at 493 No. Boulevard, Atlanta, Ga. It is also announced that its New England agent, The Detweiler-Bell Co. now has its main office at 101 Milk St., Boston, Mass., and a branch office at 152 Temple St., New Haven, Conn.

THE PENNSYLVANIA SALT MANUFACTURING Co., Philadelphia, announces that Sydney Thayer, secretary and treasurer of the Henry Bower Chemical Mfg. Co., Philadelphia, was elected a director of its company, to fill the vacancy caused by the resignation of George A. Heyl.

# Market Conditions and Price Trends

## Large Consumption of Chemicals in Last Quarter of Year

### Contracting Movement Gains Headway and Indications Point To Material Gains in Production and Distribution

ANNOUNCEMENTS of contract prices for many chemicals, as made during the past month, have been followed by a heavy buying movement. Consuming industries have shown a willingness to anticipate requirements for next year and, already, orders for deferred deliveries have taken on a volume which insures a large distribution of heavy chemicals over all of 1926. Call for prompt and nearby shipments also has been on an increasing scale and indications are favorable for a very satisfactory volume of trade during the final quarter of this year.

The condition of business in general also has appeared in a more encouraging light as is shown by the results of a survey made by the Atlantic Shippers Advisory Board. This survey rests on 40 commodity reports covering all the basic industries in the Eastern Atlantic states. It is based on accurate estimates which the various industries make relative to their car requirements for the three-month period. Among other industries, the survey foretells increased production in the automobile, chemical, fertilizer, leather, paint and oils, paper and pulp, and petroleum trades.

The comparison is with the final quarter of 1924 and on that basis it is estimated that the movement of chemicals will show an increase of 10 per cent in Oct.-Dec. period this year and also will exceed that for the preceding quarter of this year by 5 per cent. The paper and pulp business, based on the reports submitted, will show an increase of approximately 20 per cent for the quarter. Textile loadings are expected to increase from 10 to 15 per cent over last year and a similar gain is estimated for petroleum products. Expected increases in the distribution of tanning materials and paints and oils, are not set forth in definite terms but continued improvement is reported and the outlook is described as most favorable.

The figures for employment, as compiled by the Bureau of Labor, bear out reports that production has been on a progressive scale in the chemical industry and in many of the industries which consume large amounts of chemicals. The latest statistics available refer to employment for the month of September. With the exception of pulp and paper and automobile tires the index of employment was higher in all lines than in the preceding month and material gains were recorded in all industries as compared with the corresponding month of last year. As the figures for August employment were higher than those for July, it is evident that industrial activity has been on the up-grade since the summer period and a percentage of gain has been maintained in each succeeding month with good reason to believe that this condition will continue over the remainder of the year.

Index numbers for employment in September with comparisons for the preceding month and for the corresponding month last year, are as follows:

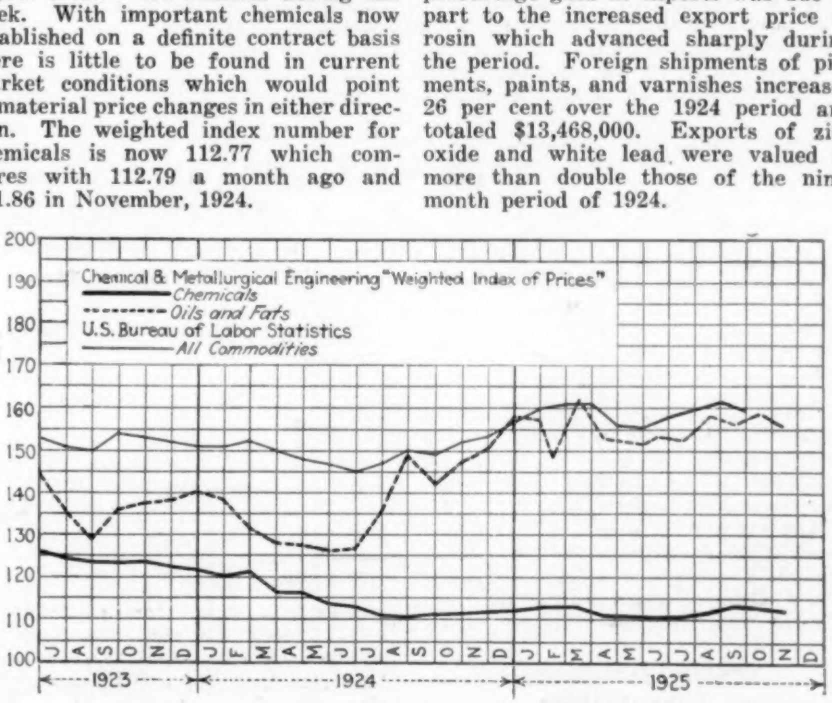
INDEX OF EMPLOYMENT

| | Sept., 1925 | Aug., 1925 | Sept., 1924 |
|---|---|---|---|
| Dyeing and finishing textiles | 96.9 | 95.2 | 90.4 |
| Leather | 90.1 | 88.0 | 86.4 |
| Paper and pulp | 92.7 | 93.6 | 92.0 |
| Chemicals | 93.4 | 90.0 | 86.6 |
| Fertilizers | 105.8 | 81.8 | 86.0 |
| Glass | 93.3 | 90.1 | 82.8 |
| Automobile tires | 118.0 | 121.5 | 107.3 |
| Petroleum refining | 98.9 | 97.4 | 90.8 |

While there was a slight decline in the weighted index number for chemical values, this does not mean that the trend of values was downward. Drastic cuts in sales prices for aqua and anhydrous ammonia were largely responsible for the change in the index but a survey of price changes reveals that practically all basic chemicals were on a firm basis and in a few cases higher levels were reached during the week. With important chemicals now established on a definite contract basis there is little to be found in current market conditions which would point to material price changes in either direction. The weighted index number for chemicals is now 112.77 which compares with 112.79 a month ago and 111.86 in November, 1924.

The three most important of the vegetable oils, cottonseed, linseed and coconut, are in a position where much uncertainty exists regarding future values. Cottonseed oil has declined substantially from the levels maintained for the greater part of the Summer but in view of the large cotton crop and the resultant seed supply, it is probable that the low level of prices has not yet been reached. Linseed oil may be expected to respond to the volume of consuming demand and to the world's supply of seed as determined later in the year by reports of the yield in the Argentine. In many quarters it is held that values for this oil will not go much below current levels. Coconut oil has been in limited supply with transportation difficulties having much to do with the smaller volume of importations. An increase in tonnage is looked for and this should be followed by an easier market. Recent declines in cottonseed, linseed, castor and oleo oils, have had a depressing effect on the weighted index number, which now stands at 155.69. A month ago the index number was 158.21 and in November, last year, it had declined to 150.53.

According to official compilations, exports of chemicals and allied products during the first nine months of this year were valued at $117,775,000 as compared with an export value of $101,884,000 for the corresponding period of 1924. Exports of naval stores valued at $24,546,000 during the nine-month period, an increase of 32 per cent over the corresponding period of 1924, represented one-fifth of the total value of such exports. The high percentage gain in exports was due in part to the increased export price of rosin which advanced sharply during the period. Foreign shipments of pigments, paints, and varnishes increased 26 per cent over the 1924 period and totaled $13,468,000. Exports of zinc oxide and white lead were valued at more than double those of the nine-month period of 1924.



# *Market Conditions and Price Trends*

## Remarkable Rise of Rayon Production Broadens Market for Chemicals

### Caustic Soda, Carbon Bisulphide, Acids and Solvents, Sulphite Pulp and Cotton Linters Are Largely Affected

During the past five years the domestic production of rayon, the chemical textile fiber, has increased more than 600 per cent and the industry continues to advance at a rate that threatens to break all precedents for commercial developments. This advance has opened an attractive market for materials and machinery already surpassing that of long established industries. For the chemical manufacturer caustic soda, carbon bisulphide, sulphuric, nitric and acetic acids, cotton linters, sulphite pulp and the volatile solvents are in most demand.

Authoritative statistics of rayon, which for several years have been compiled by *Textile World*, show a 1924 production of 38,750,000 lb. and a 1925 output (based on 6 months returns) of 54,700,000 lb. Plans and actual construction now underway will bring this figure up to nearly 75,000,000 lb. for 1926. Of the 1925 production, 86 per cent or 47,500,000 lb. will be made by the viscose process, 5,200,000 lb. by the Chardonnet or nitrocellulose process and 2,000,000 lb. by the acetate process.

*Chem. & Met.*, in its Second Annual Review Number estimated that in 1924 the rayon industry consumed 70,000,000 lb. of caustic soda or 8.7 per cent of the entire output. On this basis the industry in 1925 will have used 99,000,000 lb. of caustic while the 1926 estimate would call for 134,000,000 lb. Wood pulp is the principal source of cellulose although cotton linters are used exclusively in the nitrocellulose and acetate processes and to some extent in viscose. The U. S. Tariff Commission estimated the consumption of wood pulp in rayon in 1924 as 58,000,000 lb.

Carbon bisulphide is second only to caustic soda as a chemical raw material in the viscose process. The theoretical quantity required to produce the 34,000,000 lb. of viscose made in 1924 is 25,500,000 lb. and on the same basis the 1925 output would call for 35,600,000 lb. of carbon bisulphide. Much of this is recovered in process however, so the actual consumption is probably considerably less than these figures indicate.

Each of the 5,000,000 lb. of rayon made in 1925 by the nitrocellulose process will have required 25 to 30 lb. of mixed acid (31 per cent nitric and 54 per cent sulphuric) to nitrate the cotton linters used. Furthermore to dissolve the nitrocellulose into solution for spinning requires an ether-alcohol mixture amounting in round quantities, to 2,000,000 gal.

In the cellulose acetate process, by which 2,000,000 lb. of rayon is being made in 1925, the principal raw materials are cotton linters, acetic acid and acetic anhydride, trichlorethane and other solvents. One of the patented processes calls for 100 parts of cellulose, 800 parts of glacial acetic acid, 15 to 20 parts of sulphuric acid and 200 to 300 parts of acetic anhydride. The acetic acid and anhydride are used in large excess, and are recovered to a considerable extent. In the cuprammonium process, cotton linters, caustic soda and ammoniacal copper oxide are the chief materials.

**Domestic Production of Rayon by Companies, 1924 and 1925**

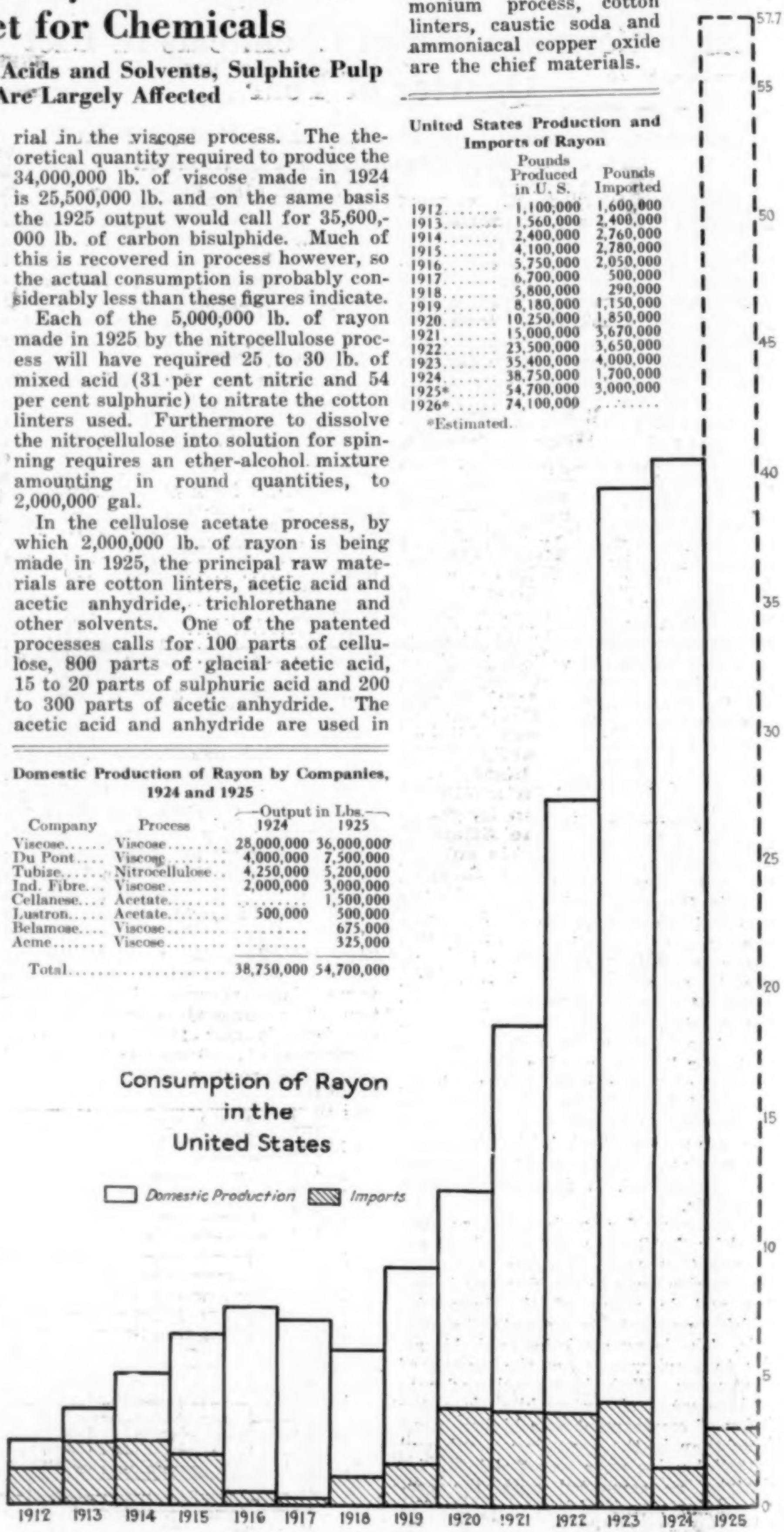
| Company | Process | Output in Lbs. 1924 | Output in Lbs. 1925 |
|---|---|---|---|
| Viscose | Viscose | 28,000,000 | 36,000,000 |
| Du Pont | Viscose | 4,000,000 | 7,500,000 |
| Tubize | Nitrocellulose | 4,250,000 | 5,200,000 |
| Ind. Fibre | Viscose | 2,000,000 | 3,000,000 |
| Cellanese | Acetate | .......... | 1,500,000 |
| Lustron | Acetate | 500,000 | 500,000 |
| Belamose | Viscose | .......... | 675,000 |
| Acme | Viscose | .......... | 325,000 |
| Total | | 38,750,000 | 54,700,000 |

**United States Production and Imports of Rayon**

| | Pounds Produced in U. S. | Pounds Imported |
|---|---|---|
| 1912 | 1,100,000 | 1,600,000 |
| 1913 | 1,560,000 | 2,400,000 |
| 1914 | 2,400,000 | 2,760,000 |
| 1915 | 4,100,000 | 2,780,000 |
| 1916 | 5,750,000 | 2,050,000 |
| 1917 | 6,700,000 | 500,000 |
| 1918 | 5,800,000 | 290,000 |
| 1919 | 8,180,000 | 1,150,000 |
| 1920 | 10,250,000 | 1,850,000 |
| 1921 | 15,000,000 | 3,670,000 |
| 1922 | 23,500,000 | 3,650,000 |
| 1923 | 35,400,000 | 4,000,000 |
| 1924 | 38,750,000 | 1,700,000 |
| 1925* | 54,700,000 | 3,000,000 |
| 1926* | 74,100,000 | ........ |

*Estimated.


World's Production of Rayon, 1924



## Market Conditions and Price Trends

# Facts and Figures of Business

### in Chemical Engineering Industries

**Industrial Statistics Presented Graphically for Those Who Follow the Monthly Trends of Production and Consumption**

ACCORDING to the index number of the Department of Commerce, production in manufacturing industries in September was 123 per cent of the average for 1919. This index number which is based on statistics covering 64 commodities, shows an increase of 8 per cent for September as compared with the corresponding month of 1924.

The principal increases over August occurred in the production of textiles, with a gain of 7 per cent, iron and steel, with a gain of 2 per cent, chemicals and oils, with a gain of 6 per cent, tobacco, with a gain of 3 per cent; and miscellaneous items, with a gain of 3 per cent. Decreases from August occurred in the production of lumber, stone, glass and clay products and non-ferrous metals, while no change occurred in the production of leather and the output of paper and printing. Compared with a year ago all groups, except manufactured foodstuffs, showed increases.

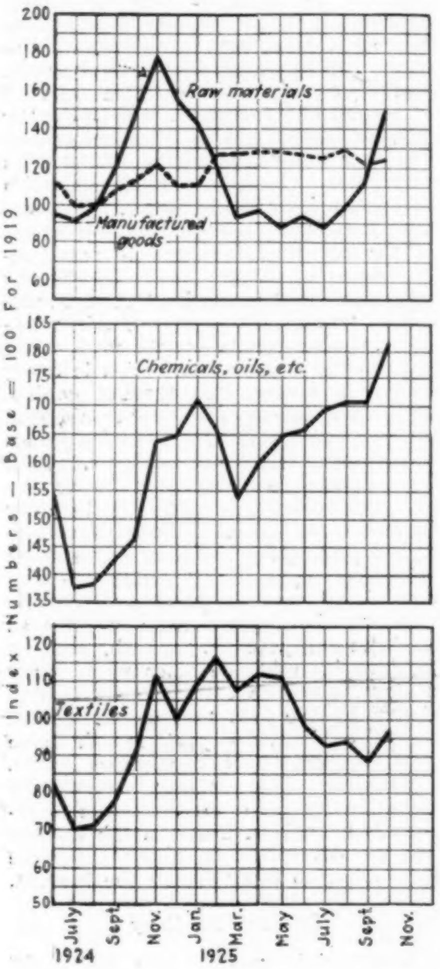
The output of raw materials was 2 per cent less than in September, 1924, the marketings of animal products decreasing 5 per cent, crop marketings 2 per cent, and mineral products 2 per cent, while forestry products increased 9 per cent.

The index of unfilled orders showed no change from August but was 13 per cent greater than a year ago, both the iron-and-steel and building-materials groups being higher than in September, 1924.

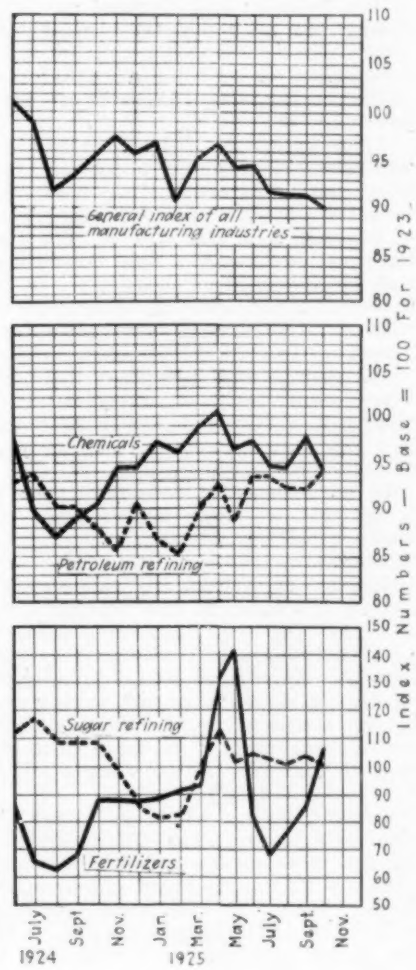
Stocks of commodities held at the end of September showed an increase of 4 per cent over August, when allowance is made for seasonal variations, and increased 10 per cent over a year ago. Stocks of raw foodstuffs and the other raw materials for manufacture were greater than in August, while the stocks of manufactured commodities were smaller and manufactured foodstuffs showed no change. All groups, however, showed increases over a year ago, except manufactured foodstuffs, which was smaller.

The general level of wholesale prices, as compiled by the Bureau of Labor, was slightly lower in September than in August. The weighted index number registered 159.7 for September compared with 160.4 for August and with 148.8 for September, 1924. Farm products were featured by declines in price and the same was true of cottonseed meal, lubricating oil, and rubber. Metals and metal products were unchanged with slight increases for foodstuffs, building materials, chemicals and drugs.

*Volume of Production*

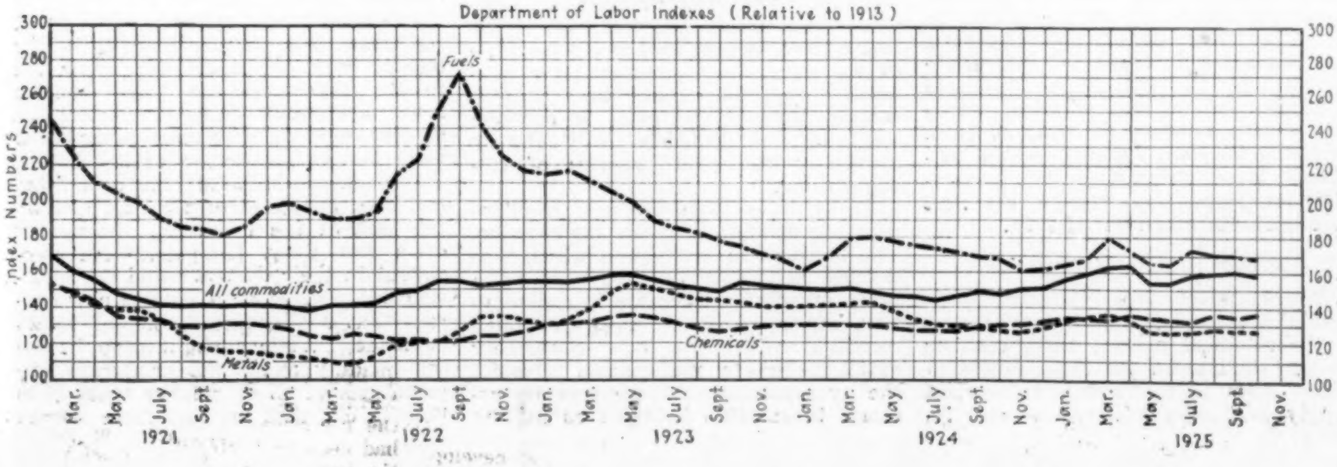



*Index of Employment*




***Wholesale Prices***

Department of Labor Indexes (Relative to 1913)



# Market Conditions and Price Trends

## Contract Prices For Alkalis Bring Consumers Into the Market

### Caustic Soda and Soda Ash Are Offered at Unchanged Price Levels For 1926 Deliveries

CONTRACT prices for caustic soda and soda ash were announced in the early part of the period. The quotations, as named for deliveries over next year, were in line with expectations as they showed no change from the figures which were in effect on 1925 business. Conditions in the manufacturing end of the industry had changed but little during the year and with practically no change in manufacturing costs, it was logical to look for a similar condition in the establishment of sales prices for the coming season.

After producers had expressed their willingness to take on orders for forward positions, consuming industries took the initiative and a large volume of business soon was placed. The contracting movement is still in evidence and by the end of December, it is thought that contract commitments will equal or surpass in volume, those placed up to the corresponding date of 1924. As the final quarter of last year saw a very heavy contract buying in alkalis, it is evident that producers are in a fair way to have the greater part of their 1926 output sold ahead.

In the absence of definite figures, it is difficult to make comparisons between totals for domestic consumption of alkalis in 1925 and 1924. It is conceded, however, that the various consuming industries of this country drew more heavily upon supplies of caustic soda and soda ash in the current year than was the case in 1924. Judging by reports of current contract buying and by the status of general industry, domestic consumption of these products in 1926 bids fair to show an increase over the 1925 totals.

Export buying of these chemicals also was more active this year and for the nine months ended September, outward shipments were considerably larger than in the corresponding periods of 1924. In connection with the export outlet in the Far East it is worthy of note that the rapid increase in consumption of caustic soda in Japan has been largely absorbed by a corresponding increase in the home production. In 1924, Japan produced 47,213,000 lb. of this chemical which was a record figure for that country. In the same year, Japan imported 34,543,000 lb. of caustic, so that production outstripped imports for the first time with the exception of 1921.

#### German Bromine Convention

Recent reports from Germany state that the most important development in the chemical market there consists in the dissolution of the convention which had been formed to control supply and sales of bromine and its products. As a matter of fact the convention never attained an important position in the industry as all arrangements and agreements were of a temporary nature. This was due to the attitude of those potash works which also manufacture bromides from bromine produced in their plant, and whose interests were, in many cases, incompatible with those of the other participants. Another obstacle to the successful operation of the convention lay in the impossibility of winning over those manufacturers who preferred to remain outside the arrangement. Since there are now fairly considerable stocks of bromine available, and that there is also a possibility of large supplies of bromides being thrown on the market, prices are liable to fluctuate in future in consequence of competition. Sodium bromide for export is quoted at about $170, while potassium bromide is scarcer and fetches about $73, and ammonium bromide $82-83 per 100 kilos, f.o.b. Hamburg. This does not affect the new arrangement for regulating the price of bromine; however, since fairly large stocks of the latter have accumulated in consequence of the very small demand, it is generally expected that the present margin between the price of bromine and that of bromides will shortly disappear owing to pressure of circumstances.

> ***Leading Market Developments During the Month***
>
> **Contract prices for soda ash and caustic soda for 1926 deliveries are the same as prevailed in the present year.**
>
> **Selling competition in the market for aqua ammonia has become more prominent and sales are made at very low levels.**
>
> **Proposals have been made at Washington to make industrial alcohol subject to a tax of one cent a gallon.**
>
> **Reduction in duty on linseed oil is probable in accordance with findings of Tariff Commission.**
>
> **Advances have featured the market for rosins and turpentine with a continuance of high prices in prospect.**

There have been no new developments in domestic markets for bromine. The increase in production which was started last year to take care of a large prospective increase in consumption, left the market in an oversupplied condition when the new consuming outlet failed to materialize. Despite the overproduction, there was no attempt to sacrifice holdings as holders took the view that volume of sales could not be increased by price considerations.

#### Ammonia Prices Lowered

The situation in the market for aqua ammonia has become more acute as selling pressure became intensified and prices have been reduced to unusually low levels. Some reports state that sales have been made at prices below the cost of production but this is difficult to verify in view of the different processes used in manufacture. As previously reported the market is feeling the pressure of two competing groups of manufacturers. The commercial development of synthetic ammonia has brought this material on the market in competition with the product of established producers who are using coal-tar byproducts as a raw material. The new product is trying to force its way into channels of consumption through price considerations. This has been met by similar tactics on the part of the old producers and in some instances the latter have taken the initiative in order to hold their accustomed trade. From an outside viewpoint, the market is of interest because it presents an arena on which is being waged a contest for market control with the existence of a long established industry at stake. It also emphasizes the changes which are going on within the chemical industry and the results of competition thus incited will go far to determine the commercial superiority of production methods which come into direct opposition. Anhydrous ammonia also has been under selling pressure but the sharp decline in price as made in the preceding month, appears to have brought the sales price about as low as sellers care to go. This is shown by the fact that openly quoted prices during the past month have held at practically unchanged levels. Predictions that selling competition would extend to all ammonia compounds have been heard in the market but no developments along that line have come to light during the interim.

#### Linseed Oil Duty

About eight months ago the Tariff Commission unanimously recommended that, under the flexible provisions of the tariff, a reduction be made in the import duty on linseed oil. This led to the almost general belief that a lower tariff would be made effective but as time went on with no announcement forthcoming, it became accepted that the recommendation of the committee had been subjected to a pocket veto on the part of the President. Advocates of a low duty, however, were persistent in their demands and the question was revived with reports now current that a slight readjustment would be made. While a slight drop in the import duty might not encourage importations of oil on a large scale, it is pointed out that arrivals from abroad

# Market Conditions and Price Trends

**Chem. & Met. Weighted Index of Chemical Prices**

Base = 100 for 1913-14

| | |
|---|---|
| **This month** | **112.77** |
| Last month | 112.79 |
| November, 1924 | 111.86 |
| November, 1923 | 122.45 |

Higher prices for bleaching powder, tin and lead salts, barium products, and caustic potash were offset by sharp reductions in ammonia products and the weighted index number shows a slight loss for the period.

have not ceased as a result of the higher tariff impost and for the nine months ended September, imports reached a total of 11,748,207 lb. This would not represent much more than 1 per cent of the total consumed in this country but with even a moderate lowering in import duty a stimulus would be given to importers and undoubtedly foreign oil would exert more influence in regulating prices in domestic markets.

Last week an official estimate of American flaxseed crop was issued. This estimate placed the total outturn this year at 22,332,000 bu. with an indicated average yield of 7.3 bu. per acre. Taking these figures as substantially correct, a large amount of seed must be imported during the coming year, in order to fill out consuming requirements. Unless a very large surplus is produced in the Argentine, there will be considerable competition in the latter market. This is not conducive to low prices for seed or oil. Indications in this country are favorable for a large demand for linseed oil. If European markets take their usual quotas of seed and if Argentine shipments should move slowly, it is possible to foresee an upward trend to oil values in the markets of the world. In fact, there are not many factors in sight which may be construed as pointing to lower price levels and it is more probable that future prices will be on a higher plane.

### Calcium Arsenate Offered

While this is an off-season for sales of calcium arsenate, there has been a disposition on the part of some sellers to attract buyers by quoting prices of 6½c. per lb. delivered at Southern points. The heavy carryover of stocks from last season has created an unfavorable condition as far as production for next year is concerned but there are mitigating factors which may work for the benefit of the industry. In the first place, the state of Georgia has withdrawn as a handler of arsenate and the competition which producers were forced to meet from that direction, no longer will exist. For four years, that State carried on the experiment of acting as a distributor of the poison and while results at first were declared to be beneficial, the attempt petered out dismally when a preponderance of supplies placed the market in an irregular position and prices were subjected to the keenest kind of competitive selling. A view of the situation as expressed by a Southern writer states that the withdrawal of the State of Georgia from the handling of calcium arsenate, after four years' experience, ends a notable experiment of government in business. The result as a whole was unsatisfactory. The first year's business was carried on smoothly, for a new venture, and met with the approval of the farmers. Since that time the officials have had their share of trouble. The demand for the poison has been uncertain and fluctuating, and manufacturers' prices have varied widely. The officials closed a contract with a western mining company for a five-years' supply of arsenate, which was to be manufactured in Georgia. The mining company was unable to build the factory, the capitalists upon whom they depended being advised that the contract price was too low to be profitable. This move made it hard for dealers to sell arsenate at market prices, and left everybody dissatisfied. No doubt the State officials are glad to be rid of a troublesome job.

Another point of vantage is found in attempts to increase educational work with a view of demonstrating the economic advantages of using calcium arsenate in the cotton-growing states. At a recent meeting of the Agricultural Insecticide and Fungicide Manufacturers Association, the secretary and treasurer of the American Cotton Association stated that "Calcium arsenate is the only insecticide which has proven practical," he added. "Every farm on which we have applied it has shown a profit per acre, ranging from $30 to $175. This profit has been from 30 per cent to 35 per cent above that of surrounding farms not so treated. It requires about 200 lb. of calcium arsenate to take care of five acres of cotton for the season. This includes eight applications."

The speaker appealed to the manufacturers to contribute 50 tons of calcium arsenate to the work of the committee conducting the demonstrations. It would require about 400,000 tons to treat half the cotton area next year, or 20,000,000 acres.

### Production of Fats and Oils

Official statistics covering the factory production of fats and oils, exclusive of refined oils and derivatives, during the three month period ended Sept. 30, 1925, was as follows: vegetable oils, 417,714,890 lb.; fish oils, 44,228,933 lb.; animal fats, 405,503,478 lb.; and grease, 82,086,837 lb., a total of 949,534,138 lb. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 304,332,491 lb. appears for lard. Next in order is cottonseed oil with 187,023,490 lb.; linseed oil with 146,306,306 lb.; tallow with 98,939,400 lb.; coconut oil with 46,135,065 lb.; and corn oil with 24,452,073 lb.

**Chem. & Met. Weighted Index of Prices for Oils and Fats**

Base = 100 for 1913-14

| | |
|---|---|
| **This month** | **155.69** |
| Last month | 158.21 |
| November, 1924 | 150.53 |
| November, 1923 | 138.10 |

The weighted index number was lower under the influence of easier markets for linseed, corn, castor, and oleo oils. Oriental oils generally held a firm position throughout the month.

The production of refined oils during the period was as follows: Cottonseed, 141,975,654 lb.; coconut, 53,160,981 lb.; peanut, 1,324,416 lb.; and corn, 19,640,729 lb. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

### Sicilian Citrate of Lime

A report from Palermo states that the Camera Agrumaria has sold for delivery almost all of the entire new production of citrate of lime. The selling price was fixed at 675 lire per hundred kilos, basis 64 per cent citric acid, ex-warehouse. The old stock has been reduced to about 15,500 tons.

### Exports of Chemicals

| | Sept. 1925 | Sept. 1924 |
|---|---|---|
| Benzol, lb | 7,506,071 | 1,204,116 |
| Aniline oil and salts, lb | 11,648 | 1,933 |
| Acid, acetic, lb | 45,674 | 107,746 |
| Acid, boric, lb | 58,333 | 68,073 |
| Acid, sulphuric, lb | 478,168 | 1,252,439 |
| Methanol, gal | 15,320 | 19,747 |
| Aluminum sulphate, lb | 3,344,974 | 3,715,348 |
| Acetate of lime, lb | 1,340,490 | 2,462,213 |
| Calcium carbide, lb | 257,874 | 377,859 |
| Bleaching powder, lb | 1,352,372 | 1,813,550 |
| Copper sulphate, lb | 240,388 | 183,271 |
| Farmaldehyde, lb | 118,877 | 178,105 |
| Potassium bichromate, lb | 40,662 | 186,509 |
| Sodium bickromate, lb | 387,005 | ........ |
| Sodium cyanide, lb | 149,205 | 203,946 |
| Borax, lb | 2,792,056 | 1,984,418 |
| Soda ash, lb | 2,413,122 | 3,026,045 |
| Sodium silicate, lb | 2,716,348 | 3,042,278 |
| Sal soda, lb | 1,053,688 | 1,469,787 |
| Caustic soda, lb | 6,378,164 | 7,206,614 |
| Sulphate of ammonia, ton | 13,912 | 9,037 |

### Imports of Chemicals

| | Sept. 1925 | Sept. 1924 |
|---|---|---|
| Dead or creosote oil, gal | 12,060,742 | 3,636,410 |
| Naphthalene, lb | 354,233 | 111,467 |
| Pyridine, lb | 123,320 | 95,649 |
| Arsenic, lb | 1,315,005 | 678,533 |
| Acid, citric, lb | 33,600 | 22,220 |
| Acid, farmic, lb | 134,056 | 143,446 |
| Acid, oxalic, lb | 187,905 | 187,786 |
| Acid, sulphuric, lb | 2,371,407 | 866,000 |
| Acid, tartaric, lb | 343,360 | 251,260 |
| Ammonia chloride, lb | 1,179,189 | 1,080,174 |
| Ammonia nitrate, lb | 1,058,736 | 427,240 |
| Barium compounds, lb | 2,241,573 | 2,176,627 |
| Calcium carbide, lb | 1,559,500 | 2,216,738 |
| Copper sulphate, lb | 224,000 | 243,159 |
| Bleaching powder, lb | 253,893 | 105,271 |
| Potassium cyanide, lb | 98,148 | 196,618 |
| Potassium carbonate, lb | 330,431 | 749,722 |
| Potassium hydroxide, lb | 1,124,851 | 832,495 |
| Potassium chlorate, lb | 791,263 | 758,265 |
| Sodium cyanide, lb | 2,128,231 | 1,483,259 |
| Sodium ferrocyanide, lb | 79,614 | 261,315 |
| Sodium nitrite, lb | 22,464 | 400 |
| Sodium nitrate, ton | 56,764 | 68,017 |
| Sulphate of ammonia, ton | 920 | 277 |

# Current Prices in the New York Market

*For Chemicals, Oils and Allied Products*

**The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to November 14.**

## Industrial Chemicals

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Acetone, drums | lb. | $0.12 -$0.13 | $0.12 -$0.13 | $0.16 -$0.16½ |
| Acid, acetic, 28%, bbl. | cwt. | 3.12 - 3.37 | 3.00 - 3.25 | 3.12 - 3.37 |
| Boric, bbl | lb. | .08½- .10 | .08½- .10 | .09 - .09½ |
| Citric, kegs | lb. | .45½- .47 | .45½- .47 | .45½- .47 |
| Formic, bbl | lb. | .10 - .11½ | .10½- .11 | .11 - .11½ |
| Gallic, tech., bbl | lb. | .45 - .50 | .45 - .50 | .45½- .47 |
| Hydrofluoric 30% carb. | lb. | .06 - .07 | .06½- .07 | .06½- .07 |
| Lactic, 44%, tech., light, bbl. | lb. | .13½- .14 | .13½- .14 | .12½- .13 |
| 22%, tech., light, bbl. | lb. | .06 - .06½ | .06½- .07 | .06 - .06½ |
| Muriatic, 18°, tanks | cwt. | .80 - .85 | .80 - .85 | .80 - .85 |
| Nitric, 36°, carboys | cwt. | .05 - .05½ | .04½- .04½ | .04 - .04½ |
| Oleum, tanks, wks. | ton | 17.50 -20.00 | 17.50 -20.00 | 16.00- 17.00 |
| Oxalic, crystals, bbl. | lb. | .10½- .11 | .10½- .11 | .09½- .10 |
| Phosphoric, tech., c'bys. | lb. | .07 - .07½ | .07 - .07½ | .07 - .08 |
| Sulphuric, 60°, tanks | ton | 8.50 - 9.50 | 8.50 - 9.50 | 8.00 - 9.00 |
| Tannic, tech., bbl | lb. | .35 - .40 | .35 - .40 | .45 - .50 |
| Tartaric, powd., bbl. | lb. | .27½- .30 | .27½- .30 | .26 - .29 |
| Tungstic, bbl | lb. | 1.00 - 1.20 | 1.00 - 1.20 | 1.20 - 1.25 |
| Alcohol, ethyl, 190 p'f. U.S.P. bbl | gal. | 4.90½- 5.00½ | 4.85 - 4.90 | 4.89 - ..... |
| Alcohol, Butyl, dr | lb. | .217-...... | .24½- .25½ | .30 -...... |
| Denatured, 190 proof No. 1 special dr | gal. | .54½-...... | .48½-...... | .56 -...... |
| No. 5, 188 proof, dr. | gal. | .53½-...... | .47½-...... | .50 -...... |
| Alum, ammonia, lump, bbl | lb. | .03½- .04 | .03½- .04 | .03½- .04 |
| Chrome, bbl | lb. | .05½- .05¾ | .05½- .05¾ | .05½- .06 |
| Potash, lump, bbl | lb. | .02¾- .03½ | .02¾- .03½ | .02¾- .03½ |
| Aluminum sulphate, com., bags | cwt. | 1.40 - 1.45 | 1.40 - 1.45 | 1.35 - 1.40 |
| Iron free, bg | cwt. | 2.00 - 2.10 | 2.00 - 2.10 | 2.35 - 2.45 |
| Aqua ammonia, 26°, drums | lb. | .03 - .04 | .05 - .06 | .06½- .06¾ |
| Ammonia, anhydrous, cyl. | lb. | .15 - .17 | .15 - .17 | .28 - .30 |
| Ammonium carbonate, powd. tech., casks | lb. | .11 - .11½ | .11 - .11½ | .12½- .12¾ |
| Nitrate, tech., casks | lb. | .08 - .08½ | .08 - .08½ | .09 - .10 |
| Sulphate, wks. | cwt. | 2.95 - ..... | 2.80 - 2.85 | 2.65 - 2.70 |
| Amylacetate tech., drums | gal. | 2.45 - 2.60 | 2.75 - 3.25 | 3.50 - 3.60 |
| Antimony Oxide, bbl. | lb. | .17 - .17½ | .17½- .18 | .13 - .13½ |
| Arsenic, white, powd., bbl. | lb. | .03½- .04½ | .03½- .04½ | .06½- .07 |
| Red, powd., kegs | lb. | .12 - .12½ | .12½- .13 | .14¾- .15½ |
| Barium carbonate, bbl | ton | 45.00 -47.00 | 52.00 -54.00 | 55.00 -56.00 |
| Chloride, bbl. | ton | 58.00 -59.00 | 61.00 -63.00 | 70.00 -72.00 |
| Nitrate, cask | lb. | .07½- .08½ | .07½ - .07½ | 7.07½- .08 |
| Blanc fixe, dry, bbl | lb. | .03¾- .04 | .03¾- .04 | .03¾- .04 |
| Bleaching powder, f.o.b., wks., drums | cwt. | 2.00 - 2.10 | 1.90 - 2.00 | 1.90 -...... |
| Borax, bbl. | lb. | .05 - .05½ | .05 - .05½ | .05½- .05½ |
| Bromine, cs. | lb. | .45 - .47 | .47 - .49 | .44 - .45 |
| Calcium acetate, bags | cwt. | 3.00 - 3.03 | 2.75 - 2.80 | 3.00 - 3.05 |
| Arsenate, dr | lb. | .07 - .08 | .06 - .07 | .08 - .09 |
| Carbide drums | lb. | .05½- .06 | .05½- .06 | .05 - .05½ |
| Chloride, fused, dr., wks. | ton | 21.00 -...... | 21.00 -...... | 21.00 -...... |
| Phosphate, bbl. | lb. | .07½- .07¾ | .07½- .07¾ | .07¾- .07½ |
| Carbon bisuphide, drums | lb. | .06 - .06½ | .05½- .06 | .06 - .06½ |
| Tetrachloride drums | lb. | .07 - .07½ | .07 - .07½ | .06½- .07 |
| Chlorine, liquid, tanks, wks. | lb. | .04 - .04½ | .04 - .04½ | .04½-...... |
| Cylinders | lb. | .05½- .08 | .05½- .08 | .05½- .08 |
| Cobalt oxide, cans | lb. | 2.10 - 2.20 | 2.10 - 2.20 | 2.10 - 2.25 |
| Copperas, bgs., f.o.b. wks. | ton | 13.30 -14.00 | 13.00- 14.00 | 15.00 -16.00 |
| Copper carbonate, bbl | lb. | .17 - .18 | .16½- .17 | .17 - .17½ |
| Cyanide, tech., bbl | lb. | .49 - .50 | .49 - .50 | .49 - .50 |
| Sulphate, bbl. | cwt. | 4.50 - 4.60 | 4.50 - 4.60 | 4.40 -...... |
| Cream of tartar, bbl. | lb. | .21½- .22 | .21½- .22 | .21 - .21½ |
| Epsom salt, dom., tech., bbl. | cwt. | 1.65 - 2.00 | 1.75 - 2.00 | 1.75 - 2.00 |
| Imp., tech., bags | cwt. | 1.30 - 1.40 | 1.30 - 1.40 | 1.35 - 1.40 |
| Ethyl acetate, 85% drums | gal. | .87 - .90 | .87 - .90 | .92 - .95 |
| 99%, dr. | gal. | 1.05 -...... | 1.05 -...... | 1.08 - 1.10 |
| Formaldehyde, 40%, bbl | lb. | .09¾- .09½ | .08¾- .09 | .09 - .09½ |
| Furfural, dr. | lb. | .23 - .25 | .23 - .25 | .25 -...... |
| Fusel oil, crude, drums | gal. | 2.25 - 2.40 | 2.40 - 2.50 | 2.90 - 3.00 |
| Refined, dr | gal. | 3.25 - 3.50 | 3.25 - 3.50 | 4.00 - 4.50 |
| Glaubers salt, bags | cwt. | 1.15 - 1.25 | 1.15 - 1.25 | 1.20 - 1.40 |
| Glycerine, c.p., drums, extra | lb. | .21½- .22 | .19 - .19½ | .18¾- .19 |
| Lead: White, basic carbonate, dry, casks | lb. | .11 - .11½ | .10¾-...... | .10½-...... |
| White, basic sulphate, sck. | lb. | .10½-...... | .09½-...... | .10 -...... |
| Red, dry, sck | lb. | .12½- .13 | .12 - .12½ | .11½-...... |
| Lead acetate, white crys., bbl. | lb. | .14½- .15 | .14½- .15 | .14½- .15 |
| Lead arsenate, powd., bbl | lb. | .16 - .17 | .16 - .17 | .16 - .18 |
| Lime, chem., bulk | ton | 8.50 -...... | 8.50 -...... | 8.50 -...... |
| Litharge, pwd., csk | lb. | .12 - .12½ | .11½- .12 | .11¾-...... |
| Lithopone, bags | lb. | .05½- .06 | .06 - .06½ | .06 - .06½ |
| Magnesium carb., tech., bags | lb. | .06¾- .07 | .06¾- .07 | .08½- .08½ |
| Methanol, 95%, dr | gal. | .57 - .62 | .57 - .62 | .74 - .76 |
| 97%, dr. | gal. | .59 - .64 | .59 - .64 | .76 - .78 |
| Nickel salt, double, bbl. | lb. | .10 - .10½ | .10 - .10½ | .09 - .10 |
| Single, bbl. | lb. | .10½- .11 | .10½- .11 | .10 - .11 |
| Orange mineral, csk. | lb. | .14½-...... | .14 -...... | .14¾- .15 |
| Phosphorus, red, cases | lb. | .70 - .75 | .75 - .80 | .70 - .75 |
| Yellow, cases | lb. | .34 - .36 | .34 - .36 | .37½- .40 |
| Potassium bichromate, casks | lb. | .08½- .08¾ | .08½- .08¾ | .08¾- .08¾ |
| Carbonate, 80-85%, calc., csk. | lb | .06 - .06 | .05½- .06 | .05 - .05½ |
| Chlorate, powd. | lb. | .08½- .09 | .08½- .09 | .07 - .07½ |
| Cyanide, cs. | lb. | .55 - .58 | .55 - .58 | .47 - .62 |
| First sorts, csk. | lb. | $0.08½-$0.09 | $0.08½-$0.09 | $0.08½-$0.08½ |
| Hydroxide (c'stic potash) dr. | lb. | .07½- .07¾ | .07½- .07¾ | .07¾- .07½ |
| Muriate, 80% bgs. | ton | 34.90 -...... | 34.90 -...... | 34.55 -...... |
| Nitrate, bbl. | lb. | .06¾- .06½ | .06½- .06½ | .06 - .07¾ |
| Permanganate, drums | lb. | .14½- .15 | .14½- .15 | .13 - .13½ |
| Prussiate, yellow, casks | lb. | .18¾- .18½ | .18 - .18¾ | .17 - .17½ |
| Sal ammoniac, white, casks | lb. | .06 - .07 | .05¾- .07 | .06½- .07¾ |
| Salsoda, bbl. | cwt. | 1.10 - 1.30 | 1.20 - 1.40 | 1.20 - 1.40 |
| Salt cake, bulk | ton | 15.00 -18.00 | 15.00 -18.00 | 16.00 -17.00 |
| Soda ash, light, 58%, bags, contract | cwt. | 1.38 -...... | 1.38 -...... | 1.38 -...... |
| Dense, bags | cwt. | 1.45 - 1.55 | 1.45 - 1.55 | 1.45 - 1.55 |
| Soda, caustic, 76%, solid, drums, contract | cwt. | 3.10 -...... | 3.10 -...... | 3.10 -...... |
| Acetate, works, bbl. | lb. | .04¾- .05 | .04¾- .05 | .04½- .05 |
| Bicarbonate, bbl. | cwt. | 2.00 - 2.25 | 2.00 - 2.25 | 1.75 - 2.00 |
| Bichromate, casks | lb. | .06½- .06¾ | .06½- .06¾ | .07¼- .07½ |
| Bisulphate, bulk | ton | 4.50 - 5.00 | 4.50 - 5.00 | 6.00 - 7.00 |
| Bisulphite, bbl | lb. | .03¾- .04 | .03¾- .04 | .04¼- .04½ |
| Chlorate, kegs | lb. | .06¼- .06½ | .06¼- .06½ | .06½- .07 |
| Chloride, tech. | ton | 12.00 -14.75 | 12.00- 14.75 | 12.00 -14.00 |
| Cyanide, cases, dom. | lb. | .18 - .22 | .18 - .22 | .20 - .22 |
| Fluoride, bbl. | lb. | .08¾- .09 | .08¾- .09 | .08½- .09 |
| Hyposulphite, bbl. | lb. | .01¾- .02½ | .01¾- .02½ | .02 - .02½ |
| Nitrate, bags | cwt. | 2.60 -...... | 2.55 -...... | 2.50 -...... |
| Nitrate, casks | lb. | .09½- .09¾ | .08¾- .09 | .09¼- .09½ |
| Phosphate, dibasic, bbl. | lb. | .03¼- .03½ | .03½- .03¾ | .03½- .03¾ |
| Prussiate, yel. drums | lb. | .10 - .10½ | .10½- .10¾ | .09¾- .10 |
| Silicate (30°, drums) | cwt. | .75 - 1.15 | .75 - 1.15 | .75 - 1.15 |
| Sulphide, fused, 60-62%, dr. | lb. | .03 - .03¼ | .03 - .03¼ | .02¾- .03 |
| Sulphite, crys., bbl | lb. | .03 - .03¾ | .02¾- .03 | .02½- .03 |
| Strontium nitrate, bbl. | lb. | .08 - .08 | .08 - .09 | .09 - .09½ |
| Sulphur, crude at mine, bulk | ton | 15.00 -16.00 | 15.00 -16.00 | 14.00 -16.00 |
| Chloride, dr | lb. | .04½- .05 | .04½- .05 | .04½- .05 |
| Dioxide, cyl | lb. | .09 - .10 | .09 - .10 | .08½- .09 |
| Flour, bag | cwt. | 15.35 - 3.00 | 2.35 - 3.00 | 2.25 - 2.35 |
| Tin bichloride, bbl. | lb. | .17¾-...... | .16¾-...... | .15 -...... |
| Oxide, bbl. | lb. | .66 -...... | .62 -...... | .56 -...... |
| Crystals, bbl. | lb. | .43 -...... | .41 -...... | .37½-...... |
| Zinc chloride, gran., bbl. | lb. | .07¾- .08 | .07¾- .08 | .06 - .07½ |
| Carbonate, bbl. | lb. | .10¾- .11 | .10¾- .11 | .12 - .14 |
| Cyanide, dr. | lb. | .40 - .41 | .40 - .41 | .40 - .41 |
| Dust, bbl. | lb. | .10 - .10½ | .10 - .10½ | .08 - .08½ |
| Zinc oxide, lead free, bag | lb. | 0.07¼-...... | 0.07¼-...... | 0.07½-...... |
| 5% lead sulphate, bags | lb. | .07 -...... | .07 -...... | .06¾-...... |
| Sulphate, bbl | cwt. | 3.00 - 3.50 | 3.00 - 3.50 | 3.00 - 3.25 |

## Oils and Fats

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Castor oil, No. 3, bbl. | lb. | $0.15 -$0.15½ | $0.15½-$0.16 | $0.17 -$0.17¼ |
| Chinawood oil, bbl. | lb. | .13½- .14 | .13½- .13¾ | .15½- .16 |
| Coconut oil, Ceylon, tanks, N. Y. | lb. | .12 -...... | .12 -...... | .10½-...... |
| Corn oil crude, tanks, (f.o.b. mill) | lb. | .10 -...... | .09¾-...... | .09½-...... |
| Cottonseed oil, crude (f.o.b. mill), tanks | lb. | .08¾-...... | .08¾-...... | .08¾- .09 |
| Linseed oil, raw, car lots, bbl. | gal. | .96 -...... | .99½-...... | 1.09 -...... |
| Palm, Lagos, casks | lb. | .09½-...... | .09 -...... | .08¼- .08½ |
| Niger, casks | lb. | .08¾-...... | .08¾-...... | .07¾-...... |
| Palm Kernel, bbl. | lb. | .11 - .11½ | .11 - .11¼ | .10 -...... |
| Peanut oil, crude, tanks (mill) | lb. | .10 -...... | .10¾-...... | .11½-...... |
| Perilla, bbl | lb. | .15½- .15¾ | .15 - .15½ | .14 - .14½ |
| Rapeseed oil, refined, bbl. | gal. | .93 - .94 | .97 - .98 | .98 - .99 |
| Sesame, bbl. | lb. | .15 - .15½ | .15 - .15½ | .13½- .13¾ |
| Soya bean tank (f.o.b. Coast) | lb. | .11½-...... | .11½-...... | .11½-...... |
| Sulphur (olive foots), bbl. | lb. | .09 -...... | .08 -...... | .09½- .09¾ |
| Cod, Newfoundland, bbl | gal. | .62 - .64 | .63 - .64 | .63 - .65 |
| Menhaden, light pressed, bbl | gal. | .67 - .69 | .70 - .72 | .70 - .72 |
| Crude, tanks (f.o.b. factory) | gal. | .55 -...... | .55 -...... | .53 - .58 |
| Whale, crude, tanks | lb. | .07½-...... | .07½-...... | ............ |
| Grease, yellow, loose | lb. | .08¾-...... | .09 -...... | .08¾-...... |
| Oleo stearine | lb. | .13½-...... | .13½-...... | .12¾-...... |
| Red oil, distilled, d.p. bbl. | lb. | .11¾- .11½ | .11¾- .11½ | .09¾- .09½ |
| Tallow, extra, loose | lb. | .09¾-...... | .09¾-...... | .09¾-...... |

## Coal-Tar Products

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Alpha-naphthol, crude, bbl. | lb. | $0.06 -$0.65 | $0.60 -$0.65 | $0.60 -$0.62 |
| Refined, bbl | lb. | .90 - .95 | .90 - .95 | .75 - .80 |
| Alpha-naphthylamine, bbl. | lb. | .35 - .36 | .35 - .36 | .35 - .36 |
| Aniline oil, drums, extra | lb. | .16 - .16½ | .17 - .17½ | .16 - .16½ |
| Aniline salts, bbl | lb. | .20 - .22 | .20 - .22 | .19 - .21 |
| Anthracene, 80%, drums | lb. | .60 - .65 | .60 - .65 | .70 - .75 |
| Benzaldehyde, U.S.P., dr. | lb. | 1.15 - 1.20 | 1.15 - 1.20 | 1.50 -...... |
| Benzidine base, bbl. | lb. | .75 - .77 | .75 - .77 | .78 - .80 |
| Benzoic acid, U.S.P., kgs. | lb. | .60 - .62 | .60 - .62 | .75 - .85 |
| Benzyl chloride, tech, dr | lb. | .25 - .26 | .30 - .31 | .35 - .36 |
| Benzol, 90%, tanks, works | gal. | .23 - .28 | .24 - .29 | .23 - .28 |
| Beta-naphthol, tech., drums | lb. | .22 - .24 | .22 - .24 | .24 - .25 |
| Cresol, U.S.P., dr. | lb. | .18 - .20 | .18 - .20 | .23 - .25 |
| Cresylic acid, 97%, dr., wks | gal. | .53 - .55 | .53 - .55 | .62 - .64 |
| Dichlorbenzene, dr. | lb. | .09 - .10 | .09 - .10 | .07 - .08 |
| Diethylaniline, dr | lb. | .55 - .60 | .55 - .57 | .59 - .61 |
| Dinitrophenol, bbl. | lb. | .30 - .33 | .30 - .33 | .35 - .38 |
| Dinitrotoluen, bbl. | lb. | .18 - .19 | .16 - .17 | .18 - .20 |
| Dip oil, 25% dr | gal. | .28 - .30 | .28 - .30 | .26 - .28 |
| Diphenylamine, bbl. | lb. | .48 - .50 | .48 - .50 | .48 - .50 |
| H-acid, bbl. | lb. | .72 - .73 | .72 - .73 | .70 - .74 |
| Michelere Ketone, bbl. | lb. | 3.00 - 3.20 | 3.00 - 3.20 | 3.00 - 3.20 |

## Coal-Tar Products—Continued

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Naphthalene, flake, bbl. | lb. | $0.05¼-$0.05¾ | $0.05 -$0.05½ | $0.04½-$0.05 |
| Nitrobenzene, dr. | lb. | .09½- .10 | .09½- .10 | .09 - .10 |
| Para-nitraniline, bbl. | lb. | .58 - .60 | .59 - .61 | .68 - .70 |
| Para-nitrotoluine, bbl. | lb. | .35 - .36 | .35 - .36 | .40 - .42 |
| Phenol, U.S.P., drums | lb. | .21 - .22 | .22 - .24 | .24 - .26 |
| Picric acid, bbl. | lb. | .25 - .26 | .25 - .26 | .20 - .22 |
| Pyridine, dr. | lb. | 4.25 - 4.30 | 4.30 - 4.35 | 4.00 - 4.10 |
| R-salt, bbl. | lb. | .40 - .44 | .40 - .44 | .50 - .55 |
| Resorcinal, tech, kegs | lb. | 1.35 - 1.40 | 1.35 - 1.40 | 1.30 - 1.40 |
| Salicylic acid, tech., bbl. | lb. | .33 - .34 | .33 - .34 | .32 - .33 |
| Solvent naphtha, w.w., tanks | gal. | .30 - .35 | .26 -...... | .24 - .25 |
| Tolidine, bbl. | lb. | .95 - .96 | .95 - .96 | 1.00- 1.05 |
| Toluene, tanks, works | gal. | .30 - .35 | .26 -...... | .31 -..... |
| Xylene, com., tanks | gal. | .31 - .36 | .26 - .27 | .25 - .27 |

## Miscellaneous

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Barytes, grd., white, bbl. | ton | $22.00-$24.00 | $17.00-$17.50 | $16.00-$17.00 |
| Casein, tech., bbl. | lb. | .13½- .14 | .13 - .13½ | .10½- .11 |
| China clay, powd., f.o.b. Ga. | ton | 10.00 -20.00 | 12.00 -15.00 | 14.00 -20.00 |
| Imported, powd. | ton | 45.00 -50.00 | 45.00 -50.00 | 45.00 -50.00 |
| Dry colors: | | | | |
| Carbon gas, black (wks.) | lb. | .07 - .07½ | .07 - .07½ | .09 - .11 |
| Prussian blue, bbl. | lb. | .34 - .36 | .34 - .36 | .36 - .38 |
| Ultramine blue, bbl. | lb. | .08 - .35 | .08 - .35 | .08 - .35 |
| Chrome green, bbl. | lb. | .28 - .30 | .28 - .30 | .28 - .30 |
| Carmine red, tins | lb. | 4.90 - 4.75 | 4.50 - 4.75 | 4.50 - 4.70 |
| Para toner | lb. | .90 - .95 | .90 - .95 | .95 - 1.00 |
| Vermilion, English, bbl. | lb. | 1.35 - 1.50 | 1.40 - 1.45 | 1.30 - 1.35 |
| Chrome yellow, C. P., bbl. | lb. | .18 - .18¾ | .18 - .18½ | .17 - .17½ |
| Feldspar, No. 1 (f.o.b. N. C.) | ton | 6.00 - 6.50 | 5.50 - 6.00 | 6.50 - 7.00 |
| Graphite, Ceylon, lump, bbl. | lb. | .08½- .09 | .08½- .09 | .05¾- .06 |
| Gum copal, Congo, bags | lb. | .08½- .10 | .08½- .10 | .09 - .14 |
| Manila, bags | lb. | .14 - .16 | .14 - .16 | .18 - .19 |
| Damar, Batavia, cases | lb. | .25 - .26 | .25 - .26 | .23½- .24 |
| Kauri, No. 1 cases | lb. | .57 - .65 | .60 - .65 | .60 - .65 |
| Kieselguhr (f.o.b. N. Y.) | ton | 50.00 -55.00 | 50.00 -55.00 | 50.00 -55.00 |
| Manganese, calc. | ton | 40.00 -41.00 | 35.00 -42.00 | 35.00 -40.00 |
| Pumice stone, lump, bbl. | lb. | .04½- .06 | .04½- .08 | .05 - .05½ |
| Imported, casks | lb. | .03 - .40 | .03 - .40 | .03 - .35 |
| Shellac, orange, fine, bags | lb. | .52 - .53 | .55 - .57 | .63 - .64 |
| Bleached, bonedry, bags | lb. | .59 - .62 | .61 - .67 | .71 - .72 |
| T. N., bags | lb. | .49 - .51 | .53 - .55 | .59 - .60 |
| Soapstone (f.o.b. Vt.), bags | ton | 9.00 -10.00 | 7.00 - 7.50 | 7.50 - 8.00 |
| Talc, 200 mesh (f.o.b. Vt.) | ton | 11.00 -...... | 11.00 -...... | 10.00 -...... |
| 200 mesh (f.o.b. Ga.) | ton | 7.50 -10.00 | 7.50 -10.00 | 8.00 -12.00 |
| 325 mesh (f.o.b. N. Y.) | ton | 14.75 -...... | 14.75 -...... | 14.75 -...... |
| Wax, Bayberry, bbl. | lb. | .20 - .21 | .20 - .22 | .21 - .21½ |
| Beeswax, ref., light | lb. | .43 - .44 | .42 - .43 | .29½- .30 |
| Candelilla, bags | lb. | .30 - .31 | .30 - .31 | .27 - .27½ |
| Carnauba, No. 1, bags | lb | .45 - .46 | .43 - .44 | .36 - .37 |
| Parafine, crude 105-110 m.p. | lb. | .05½- .06 | .06 - .06¼ | .06¼-...... |

## Ferro-Alloys

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Ferrotitanium, 15-18% | ton | $200.00-...... | $200.00-...... | $200.00-...... |
| Ferrochromium, 1-2% | lb. | .23- .35 | .23- .35 | .30-...... |
| Ferromanganese, 78-82% | ton | 115.00-...... | 115.00-...... | 92.50-95.00 |
| Spiegeleisen, 19-21% | ton | 33.00-34.00 | 32.00-33.00 | 33.00-35.00 |
| Ferrosilicon, 10-12% | ton | 33.00-38.00 | 33.00-38.00 | 39.50-43.00 |
| Ferrotungsten, 70-80% | lb. | 1.14- 1.20 | 1.15-...... | .88- .90 |
| Ferro-uranium, 35-50% | lb. | 4.50-...... | 4.50-...... | 4.50-...... |
| Ferrovanadium, 30-40% | lb. | 3.25- 4.00 | 3.25- 4.00 | 3.25- 3.75 |

## Non-Ferrous Metals

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Copper, electrolytic | lb. | $0.14¼-$0.14½ | $0.14¼-$0.14½ | $.012¼-$0.12¾ |
| Aluminum, 96-99% | lb. | .28 - .29 | .28 -...... | .27 - .28 |
| Antimony, Chin. and Jap. | lb. | .20 - .20½ | .16¾- .17¼ | .11⅛- .11¼ |
| Nickel, 99% | lb. | .34 -...... | .33 - .34 | .29 - .30 |
| Monel metal, blocks | lb. | .32 - .33 | .32 - .33 | .32 - .33 |
| Tin, 5-ton lots, Straits | lb. | .62½-...... | .60½-...... | .49⅛-...... |
| Lead, New York, spot | lb. | .09¾-...... | .09½-...... | .08 -...... |
| Zinc, New York, spot | lb. | .09⅛-...... | .08 -...... | .0655...... |
| Silver, commercial | oz. | .69½-...... | .70½-...... | .72⅛-...... |
| Cadmium | lb. | .60 -...... | .60 -...... | .60 -...... |
| Bismuth, 508-lb. lots | lb. | 2.65 - 2.70 | 2.65 - 2.70 | 1.85 - 1.90 |
| Cobalt | lb. | 2.50 -...... | 2.50 -...... | 2.50 - 3.00 |
| Magnesium, ingots, 99% | lb. | 1.00 -...... | 1.00 -...... | .90 - .95 |
| Platinum, ref. | oz. | 120.00-...... | 120.00-...... | 118.00-...... |
| Palladium, ref. | oz. | 78.00- 83.00 | 78.00- 83.00 | 78.00-...... |
| Mercury, flask 75 | lb. | 88.00-...... | 82.50- 83.00 | 71.00-...... |
| Tungsten powder | lb. | 1.20-...... | .20-...... | .95- 1.00 |

## Ores and Semi-finished Products

| | | Current Price | Last Month | Last Year |
|---|---|---|---|---|
| Bauxite, crushed, wks. | ton | $5.50- $8.50 | $5.50- $8.50 | $5.50- $8.75 |
| Chrome ore, c.f. post | ton | 20.50- 23.50 | 20.50- 23.50 | 18.50- 24.00 |
| Coke, fdry., f.o.b. ovens | ton | 3.75- 4.25 | 3.75- 4.25 | 4.00- 4.50 |
| Fluorspar, gravel, f.o.b. Ill. | ton | 16.00- 18.00 | 16.00- 18.00 | 17.50- 18.50 |
| Ilmenite, 52% $TiO_2$, Va. | lb. | .01½-...... | .01½-...... | .01¼-...... |
| Manganese ore, 50% Mn., c.i.f. Atlantic Ports | unit | .42 - .44 | .42 - .44 | .41 - .45 |
| Molybdemite, 85% $MoS_2$ per lb. $MoS_2$, N. Y. | lb. | .65 - .70 | .60 - .70 | .70 - .75 |
| Monazite, 6% of $ThO_2$ | ton | 120.00-...... | 120.00-...... | 120.00-...... |
| Pyrites, Span. fines, c.i.f. | unit | .12½-...... | .12½-...... | .11½- .12 |
| Rutile, 94-96% $TiO_2$ | lb. | .12 - .15 | .12 - .15 | .12 - .15 |
| Tungsten, scheelite, 60% $WO_3$ and over | unit | 12.50 -13.00 | 12.50 -13.00 | 9.00 -...... |
| Vanadium ore, per lb. $V_2O_5$ | lb. | 1.00 - 1.25 | 1.00 - 1.05 | 1.00 - 1.25 |
| Zircon, 99% | lb. | .03 -...... | .03 -...... | .06 - .07 |

# Current Industrial Developments

***New Construction and Machinery Requirements***

### *New England*

**Conn., Bridgeport**—Raybestos Co., Bostwick and Railroad Aves., awarded contract for the construction of a 2 story, 95 x 157 ft. brake lining factory, to T. J. Pardy, 1481 Seaview St. Estimated cost $60,000.

**Conn., Bristol**—Bristol & Plainview Electric Co., 17 Riverside Ave., will build an extension to gas plant also a high power gas main through East Bristol to Plainville by day labor here. Estimated cost $50,000. Equipment will be installed.

**Conn., Middletown**—Wesleyan University, J. H. McConaughy, Pres., awarded contract for the construction of a chemical laboratory on Campus, to J. H. Mylechreest, 50 Brainard Ave. Estimated cost $350,000.

**Conn., Norwalk** — Meyers Mfg. Co., 47 West Ave., lessee, awarded contract for the remodeling of factory to be used for the manufacture of leather goods, to M. J. Riordan, Hoyt St. Estimated cost $30,000.

**Conn., Waterbury**—American Brass Co., Grand St., awarded contract for the construction of a 3 story, 62 x 137 ft. factory on Jewelry St. to Tracy Bros., 52 Benedict St. Estimated cost $75,000.

**Mass., Cambridge** (Boston P. O.)—H. D. Foss & Co., Inc., H. D. Foss, Pres., Main St., plans the construction of a 5 story addition to candy factory. Estimated cost $50,000. Architect not selected.

**Mass., Hudson**—Firestone-Apsley Rubber Co., H. S. Firestone, Pres., plans the construction of a 5 story rubber footwear factory. Estimated cost $500,000. Architect not selected.

**Mass., Plymouth** — Plasterite Co., 170 Summer St., Boston, awarded contract for the construction of a 6 story, 50 x 100 ft. factory on Lothrop St. here to Joseph Malagutti & Sons. Estimated cost $100,000.

**Mass., South Hadley**—American Tissue Paper Co., B. S. Perkins, Mgr., awarded contract for the construction of a 1 story, 60 x 105 ft. addition to paper mill at Pearl City Section to Daniel O'Connell's Sons, 480 Hampden St., Holyoke. Estimated cost $40,000.

**Mass., West Springfield** (Springfield P. O.)—New England Smelting Co., 220 Union St., is receiving bids for the construction of a 1 story plant. Estimated cost $40,000. J. W. Donahue, 105 Bridge St., Springfield, is architect.

### *Middle Atlantic*

**D. C., Washington**—Bureau of Yards & Docks, Navy Dept., will receive bids until Dec. 2 for the construction of a Naval research laboratory at Research Annex Building.

**Md., Canton** (Baltimore P. O.)—Summers Fertilizer Co., J. E. Totman, Pres., Stock Exchange Bldg., Baltimore, awarded contract for the design and construction of a 1 story, 200 x 200 ft. storage plant here, to The Austin Co., Broad and Clearfield Sts., Philadelphia, Pa. Estimated cost $200,000.

**Md., College Park**—University of Maryland, will soon award contract for the construction of a 3 story, 74 x 112 ft. chemistry building. Estimated cost $150,000. Smith & May, Calvert Bldg., Baltimore, are architects.

**N. J., Bloomfield**—Westinghouse Lamp Co., 150 Broadway, New York, N. Y., awarded contract for the construction of a 2 story, 93 x 113 ft. research laboratory to Stone & Webster, Inc., 147 Milk St., Boston, Mass. A. Y. Hodgdon, is superintendent of construction.

**N. J., Gloucester**—Forrest Mercerizing Co., will soon award contract for addition to manufacturing plant including a 2 story, 44 x 119 ft. mill, boiler house, etc. on Essex St. C. E. Wunder, 520 Locust St., Philadelphia, Pa., is architect.

**N. J., Jersey City** — National Asbestos Mfg. Co., awarded contract for the construction of a 5 story factory to Industrial Engineering Co., 30 Church St. Estimated cost $100,000.

**Pa., Bellefonte**—American Lime & Stone Co., has authorized the construction of an additional rotary kiln 9 x 175 ft. A. C. Hewitt, is engineer. W. R. Cliffe, is field superintendent.

**Pa., Hercules** (Belfast P. O.)—Hercules Portland Cement Corp., 1600 Walnut St., Philadelphia, will soon award contract for the construction of a 2 story, 65 x 120 ft. pack house here. P. M. Sax, Penfield Bldg., Philadelphia, is architect.

**Pa., McKees Rocks**—Pittsburgh & Lake Erie R.R., Southfield St., Pittsburgh, awarded contract for the construction of a 2 story lacquer building to Walker & Curley, Sharpsburg. Estimated cost $40,000.

**Pa., New Brighton**—Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, awarded contract for the construction of a 4 story, 30 x 50 ft. addition to chemical building here to B. A. Groah Construction Co., 847 West North Ave., Pittsburgh. Estimated cost $50,000.

**Pa., Petrolia**—W. H. Daugherty & Sons, plans the construction of a 1 story, 40 x 46 ft. absorption refrigeration plant including 2 aqua receivers, brine cooler, anhydride receiver, ammonia pumps, generator analyzer, D.P. charger, water, brine and charging pumps, two 20 ft. diameter x 20 ft. deep brick and concrete settling tanks, 5 x 9 x 6 ft. brick or tile brine tank, etc. Estimated cost $40,000. Carbondale Machine Co., Carbondale, is engineer.

**Pa., Philadelphia** — Delany Co. Inc., awarded contract for the construction of a 1 story, 75 x 218 ft. addition to factory for the manufacture of glue. Estimated cost $70,000. Private plans.

**Pa., Philadelphia** — Harris & Richards,

Drexel Bldg., Archts., will receive bids until Nov. 17 for the construction of a 1 story, 28 x 252 ft. galvanizing building at 68th and Glenmore Sts. for General Electric Co., Witherspoon Bldg.

**Pa., Pittsburgh**—Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., awarded contract for 60 Wilputte type coke ovens with primary coolers to Wilputte Coke Oven Corp., 469 5th Ave., New York, N. Y.

**Pa., Uniontown**—Richmond Radiator Co., is having plans prepared for the construction of a 1 story, 40 x 136 ft. addition to enameling plant. Private plans.

## South

**Fla., Tampa**—Tampa Portland Cement Co., J. S. Senior, James Bldg., Chattanooga, Tenn., Pres., has acquired a 25 acre site and plans the construction of a cement manufacturing plant including 3 rotary kilns, concrete storage silos, 200,000 bbls. capacity, etc., on Hookers Point, here. Cowham Engineering Co., 111 West Monroe St., Chicago, Ill., are contractors.

**Ga., Atlanta** — Whitehead Realty Co., awarded contract for the construction of a 4 story, 40 x 80 ft. candy manufacturing plant to Smith & Williams, Inc., 407 Wayne-Claughton Bldg. Estimated cost $50,000. Morris Candy Co., is lessee.

**Miss., McComb**—X. A. Kramer, Engr., wants prices and data on equipment for creosote plant.

**N. C., Charlotte**—Lockwood, Greene & Co., Piedmont Bldg., Engrs., are supervising the construction of a manufacturing building containing 12,000 sq.ft. for C. E. Barker, Piedmont Bldg. Salembier & Villate, Inc., lessee, will use it for processing real and artificial silk.

**Tenn., Ducktown** — Ducktown Sulphur Copper & Iron Co., Ltd., Ducktown, property has been transferred and will be known as Ducktown Chemical & Iron Co., W. F. Lamoreaux, Ducktown, H. D Waldbridge, 14 Wall St., New York, N. Y., and associates. The company plans to expend between $300,000 and $400,000 for improvements to plant.

**Tenn., Memphis**—University of Tennessee, will soon award contract for the construction of a laboratory on Monroe Ave. for the medical school. Estimated cost $150,000. Jones & Furbinger, Porter Bldg., are architects.

**W. Va., Parkersburg**—Ballinger Co., 12th and Chestnut Sts., Philadelphia, Pa., Archt., will receive bids until Nov. 29 for the construction of a 1, 2 and 3 story manufacturing plant here for the Viscose Co., Marcus Hook, Pa. Estimated cost $2,000,000.

## Middle West

**Ill., Chicago**—A. A. Sprague, Comr. of Public Works, City Hall, will receive bids until Nov. 24 for furnishing and delivering approximately 1,300,000 lb. of liquid chlorine at the Municipal warehouse, 3150 South Sacramento Ave.

**Mich., Dearborn**—Ford Motor Co., Highland Park, is receiving bids for the construction of a 1 story, 201 x 318 ft. shop and laboratory extension on Oakwood Blvd. A Kahn, 1000 Marquette Bldg., Detroit, is architect.

**O., Akron**—General Tire & Rubber Co., A. C. Stoller, Purch. Agt., awarded contract for the construction of a 3 story, 100 x 100 ft. addition to factory to Carmichael Construction Co., Central Savings Bldg. Estimated cost $75,000.

**O., Mansfield** — The Mansfield Vitreous Enameling Co., E. M. Olin, Pres., is in the market for enameling equipment to double capacity of plant. Capital has been increased from $100,000 to $200,000.

**O., Mansfield**—Vitreous Enameling Co. plans the construction of addition to factory. Estimated cost $40,000. New machinery will be required.

**O., Newark**—Pharis Tire & Rubber Co., A. R. Lindorf, Pres., 765 West Main St., has had plans prepared for the construction of a 2 story, 80 x 105 ft. addition to factory. Estimated cost $60,000. Osborn Engineering Co., 2016 Euclid Ave., Cleveland, is architect.

**O., Summitville**—Summit Brick Co., c/o F. H. Johnson and H. P. Lynn, plan the construction of a 1 story factory to replace fire loss. Estimated cost $50,000. Owner is in the market for clay making machinery.

**O., Union Furnace**—Mercer Refractory Clay Co., W. T. Matthews, Mgr., is in the market for medium sized stone crusher and other equipment for plant.

**O., Wadsworth**—Wadsworth Salt Co., plans the reconstruction of plant for the manufacture of salt and by-products. Estimated cost $350,000. Machinery will be required.

**Wis., Appleton**—Fox River Paper Co., E. L. Small, Ch. Engr., awarded contract for the construction of a 1 story, 80 x 102 ft. machine room and filter plant to C. R. Meyer & Son, 50 State St. Estimated cost $60,000.

**Wis., Cudahy** — Federal Rubber Co., awarded contract for the construction of a 140 x 210 ft. manufacturing plant to Siderits Construction Co., 1591 2nd St., Milwaukee. Special rubber tire working machinery will be installed.

**Wis., Kaukauna**—W. C. Sullivan, et al, Central Block, plans the construction of a 2 and 3 story cannery. Estimated cost $100,000. Architect not selected. Canning and conveying machinery will be required.

**Wis., Kohler**—Kohler Co., awarded contract for the construction of a 5 story, 82 x 200 ft. brass manufacturing plant to H. Schmitt & Son, 430 Farwell Ave. Estimated cost $200,000.

**Wis., Milwaukee**—Crucible Steel Casting Co., 612 Clinton St., awarded contract for the construction of a 1 story, 136 x 382 and 40 x 60 ft. foundry and pattern storage at 11th Ave. and R.R. tracks to W. W. Oeflein Inc., 86 Michigan St. Estimated cost $120,000.

**Wis., Milwaukee**—L. J. Mueller Furnace Co., 197 Reed St., is in the market for an electric japanning oven.

**Wis., Racine**—S. C. Johnson & Son Co., 1012 16th St., awarded contract for the construction of a 1 story, 62 x 150 ft. addition to factory for the manufacture of furniture and floor wax, etc. to A. C. Koppel, 526 Wisconsin St. Estimated cost $40,000.

**Wis., Tanesville**—Champion Oil Co., 1232 Western Ave., plans the construction of a 1 story, 77 x 120 ft. compounding plant. Estimated cost $50,000. Architect not selected.

## West of Mississippi

**Ark., Camden** — Gillihand Oil Co. and Camden Carbon Co., plans the construction of a casinghead gasoline absorption and carbon black plant at Cardondale three miles south of here. Estimated cost $600,000. Private plans.

**Minn., Minneapolis**—Dept. of Administration & Finance, State Capitol, St. Paul, will soon award contract for the construction of a 2 story, 50 x 110 ft. laboratory for the State Highway Dept. here. Estimated cost $70,000. C. H. Johnson, 715 Capital Bank Bldg., St. Paul, is architect.

**Minn., Montgomery** — Minnesota Valley Canning Co., plans the construction of a factory. Estimated cost $250,000.

**Mo., Kansas City**—Suvall Paint & Glass Co., awarded contract for the construction of a 3 story, 60 x 72 ft. factory building and warehouse to J. R. Vansant Construction Co., 417 Dwight Bldg. Estimated cost $50,000.

**Mo., St. Louis**—Mavrakos Candy Co., 4949 Delmar Blvd., awarded contract for the construction of a 2 story, 100 x 167 ft. factory at Delmar Blvd. and Walton St. to Lotz Construction Co., Dolph Bldg.

**Mo., St. Louis**—St. Louis Coke & Iron Co., 117 North 4th St., awarded contract for the construction of a blast furnace to Peter Conley Co., Leetsdale, Pa. Estimated cost $2,000,000.

**Neb., Minatare**—Great Western Sugar Co., Scottsbluff, will build a 2 story sugar factory. Estimated cost $100,000. Private plans. Work will be done by company forces.

**N. M., Artesia**—Ohio Oil Co., is having plans prepared for the construction of an oil refinery. Machinery for a 3,000 bbl. plant will be required. Estimated cost $200,000. Company engineers in charge.

**Okla., Ponca City**—Marland Refining Co., awarded contract for the construction of a 1 story, 90 x 200 ft. machine shop and 1 story, 50 x 60 ft. blacksmith shop for refinery to H. W. Underhill, 235 North Waco St., Wichita, Kan. Estimated cost $100,000.

**Tex., Port Arthur**—Gulf Refining Co., plans the construction of 20 high pressure gasoline stills. Estimated cost $1,500,000. Company engineers in charge.

## Far West

**Calif., Fresno**—General Petroleum Corp. 310 Sansome St., San Francisco, plans the construction of a distributing plant including storage tanks, warehouse buildings, etc. Estimated cost $50,000. Company engineers in charge.

**Calif., Los Angeles**—Goodyear Tire & Rubber Co., 6701 South Central Ave., awarded contract for the construction of a 4 story, 100 x 280 ft. warehouse on Central Ave. near Florence Ave. to Lynch-Cannon Engineering Co., 1027 Chapman Bldg., cost $205,000.

**Calif., Napa**—Northwestern Sugar Refining Co., c/o S. H. Wyckoff, plans the construction of a sugar refinery. Estimated cost to exceed $100,000. F. Hinze, Pres.

**Calif., Pittsburgh**—Johns-Manville Co., 500 Post St., San Francisco, will build four 1 story, 100 x 500 ft. factory buildings on Industrial Row here, by day labor. Estimated cost $1,000,000. Work will be done under the supervision of P. A. Andrews, construction superintendent.

**Calif., Placerville** — El Dorado High School, W. A. Rantz, Secy. of Dist., is receiving bids for the installation of a Universal electrically operated gas plant with duplex carburetor tank equipped with 5 carburetors, 12 ft. long, ½ hp. single ph. motor, self re-boring air unit and 450 gal. storage tank.

**Calif., Riverside**—Soda Potash Products Co., Loew's State Bldg., Los Angeles, awarded contract for the construction of ten units, 95 x 200 ft. each here, to Union Engineering Co., 301 Bartlett Bldg., Los Angeles. Estimated cost $1,250,000.

**Calif., Tracy**—City plans the construction of a municipal gas plant. Estimated cost $120,000.

**Wash., Camas**—Crown-Willamette Paper Co., awarded contract for the construction of a new 2 and 3 story, 80 x 322 ft. kraft mill, 60 tons of kraft pulp daily capacity to Hansen-Hammond Co., Pittock Bldg., Portland, Ore. Estimated total cost to exceed $1,500,000.

**Wash., Tacoma**—The Latimer-Goodwin Chemical Co., C. A. Latimer, Pres., Grand Junctional, Colo., has purchased a site and plans the construction of an insecticide factory here. Estimated cost $50,000.

## Canada

**Man., Fort Alexander**—Manitoba Pulp & Paper Co., Ltd., Winnipeg, will soon award contract for the construction of a group of buildings for pulp and paper mill here. Contract for foundation has been awarded. Total estimated cost $4,500,000. Company engineers in charge.

**Ont., Hawkesburg**—Riordon Pulp Corp., 355 Beaver Hall, Montreal, wants prices and data on a burner suitable for burning bark.

**Ont., London**—Bd. of Education, S. F. Lawrason, Chn., awarded contract for the construction of a 2 story, 65 x 185 ft. high school on Dundas St. to J. Putherbough, 272 Regent St. Estimated cost $300,000. Equipment for chemistry and physics laboratories will be installed.

**Ont., London** — Canada Buffer Co., 62½ Dundas St., W. G. Rickett, Mgr., wants prices and data on equipment for the manufacture of polishes, polishing equipment for floors, buffing wheels etc. for plant. All machinery to be electrically driven. Estimated cost $40,000.

**Que., Montreal**—Standard Graphite Co., Ltd., 425 Phillips Place, wants prices on grinding machines.

**Que., Montreal East** — Nations Oil Refining Co. Ltd., will soon be in the market for machinery and equipment for extension to plant now under construction.

## Foreign

**Germany, Sobernheim, Rheinland**—Carl Ewald, manufacturer of glues, leather, gelatine, etc., is receiving bids from American manufacturers for automatic weighing and wrapping machines for small quantities of gelatine powder.

## Incorporations

The Crown Water Co., Bridgeport, Conn., $25,000 to manufacture disinfectants, bleaching water and various other chemicals. M. Schachter, G. Schachter, M. Osiol, Bridgeport, Conn.

International Amisite Co., Wilmington, Del., manufacturer, $600,000. (Delaware Registration Trust Co., Dover, Del.)

The Atlas Plywood Corporation, Boston, Mass., tanning, 50,000 shares stock no par value. R. S. Ingram, T. R. Winchell, P. M. Hendrie, Boston, Mass.

The Coal Products & Carbide Co., Inc., Boston, Mass., 1,000 shares of stock without par value. H. D. Foss, A. S. Jaquith, H. P. Cannon, 610 Compton Bldg., Boston, Mass.

The American Blacking Co., Lynn, Mass., $100,000. R. A. Gagan, Pres. and Treas., 193 Pleasant St., Brookline, Mass.

Crystal Sole Tanning Co., Salem, Mass., $50,000. A. L. Cohen, M. Cohen and R. Cohen, Lynn, Mass.

The Arcade Smelting & Refining Co., Springfield, Mass., metals, $70,000. H. P. Blumenaner, Pres. and Treas., Worcester, Mass.

New England Fireworks Mfg. & Display Co., Inc., Springfield, Mass., 500 shares of no par value stock, P. Napolitan, Pres., S. Napolitan, Treas., J. Napolitan, Secy., 524 Union St., Springfield, Mass.

D. S. Products Corporation, New York, N. Y., compounds to increase efficiency of gasoline, $100,000. M. S. Krauss, T. H. Dobbins, A. V. Jennings. (Atty., J. C. Panderford, Grand Central Terminal, New York, N. Y.)

American Rayon Co., Philadelphia, Pa., manufacture artificial silk, $100,000. (Corporation Guarantee and Trust Co.)